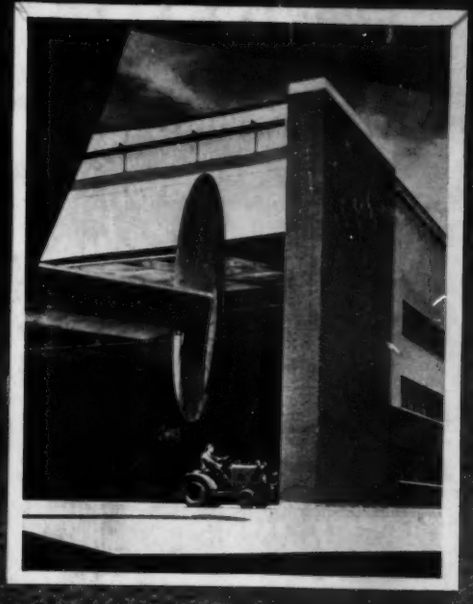
ARCHITECTURAL

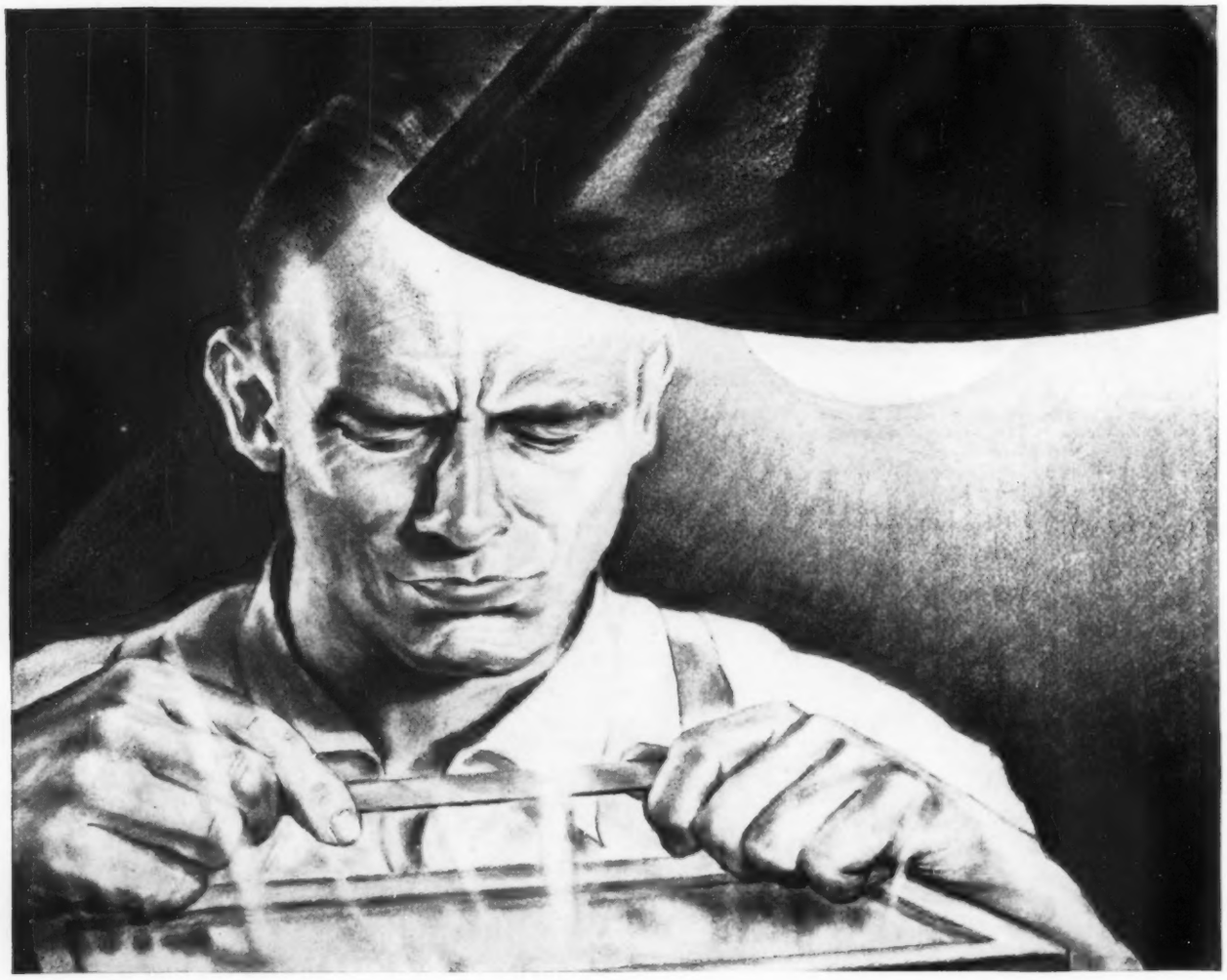
RECORD



SEPTEMBER 1942

OMBER PLANT . . POTENTIALS FOR POSTWAR WORK
ILLOW RUN HOUSING . . INDUSTRIAL LIGHTING

A MILLER Message inspired by WPB's helpful handbook, "Plant Efficiency."



How to save Industry from "SQUINTING SAMS"

You can help workers see clearly and sharply . . . at all times, on all jobs. Provide your clients with adequate lighting for fast, precision war production. Give them real working *daylight* from a MILLER *Continuous Wireway* Fluorescent Lighting System.

WPB says better lighting brings these benefits . . . "1— Increased production; 2— Better workmanship; 3— Continued production by older employees; 4— Less eyestrain; 5— Reduction in accidents; 6— Better morale; 7— Better housekeeping."

In war plants from coast to coast the MILLER *Continuous Wireway* Fluorescent Lighting System is now delivering such benefits.

MILLER 50 FOOT CANDLER or 100 FOOT CANDLER will provide your clients with fine, man-made *daylight* . . . adequate, productive illumination evenly distributed over every working surface. MILLER TROFFERS will duplicate that performance in their plant offices and drafting room.

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Pioneers in Good Lighting Since 1844

• MILLER offers a complete line of filament and fluorescent lighting equipment.

ARCHITECTURAL
RECORD
COMBINED WITH AMERICAN ARCHITECT AND ARCHITECTURE

VOL. 92 **SEPTEMBER 1942** NO. 3

NEXT MONTH

THE war effort is intensified and accelerated by the certain knowledge that Americans are fighting to build a better future for every man, a better environment for all his activities. The vision of the future must be made real and graphic by postwar planning. What architects can do in this planning is told next month in a case-history article by an architect experienced in the Public Works Reserve. The men and methods that will be employed in working out plans for the future are discussed by an educator at one of the leading universities, whose business it is to train men to cope with all the problems of postwar planning.

The need for schools is felt today and will be met in the future. Ideas for modern schools are given in picture and precept in the October issue, useful in planning now for building later. A building type much to the fore in new communities, and in remodeling, to take care of merchandizing changes, is the retail store, the community shopping center. Our Building Types Study will cover the possibilities and actualities of store remodeling within the restrictions imposed by war conditions. The what, why, where, and how of present day store practice.

And practical working details of store building and remodeling under present conditions make a most useful series of Time Saver Standards.

F. W. DODGE CORPORATION
H. JUDD PAYNE, Vice President in charge of MAGAZINE DIVISION

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WASHINGTON NEWS

By WILLIAM J. CASEY

Curb on Army Building • Substitute Materials • Fuel Oil Rationing • New Lumber Order • Postwar Building • Construction Machinery • Clear Plans • NHA on Shortage • New Defense Housing Areas • When Rent Ceilings Are Raised

BUILDING has a big stake in the current specter of war plants shutting down for lack of materials. It will mean further reorganization of WPB's material control procedure—the most severe tightening so far. WPB will carry on but the Army and Navy will have a bigger say in material distribution. As a result of this there will be more for tanks, planes and guns—less for housing and other home front needs. Military men are hardboiled about more housing except in *extremely* tight areas. At this point it looks as though WPB is going to count on a detailed scheduling job to relieve the material bottleneck. Their men will be sent out into plants to speed up urgent production, hold back production which is going too fast. Better distribution of materials may help housing projects which get cleared, but the attitude on clearing projects will become a lot tougher. Emphasis will shift to spotting projects in acute problem areas like Seattle, Detroit, Norfolk, etc. The intensified need to conserve materials may exert pressure in favor of more public housing, less private housing.

Curb on Army building

The Army has placed stiffer restrictions on the use of critical materials in its $7,500,000,000 construction program. Restrictions continue severe on copper, rubber, steel, zinc, lead and aluminum. Chromium, magnesium, and nickel are virtually barred. Additional prohibitions limit further the use of drying oils, fuel oil, wool, mahogany and aircraft grades of spruce.

In placing these restrictions the Army proudly points to substitutions already made. Use of copper and brass, along with structural steel and steel plate, has been drastically curtailed or eliminated entirely where possible by the Corps of Engineers, which is in charge of Army construction. Copper flashing for roofs and walls, for example, is replaced by flashing of asphalt-coated steel. Brass in bathroom fixtures has virtually disappeared in Army construction. Various flush valves were re-designed to halve the brass content. On faucets alone some 35,000 pounds of brass will have been saved by the end of 1942.

Substitute materials

A considerable amount of rubber insulation has been eliminated by the use of weatherproofed wiring and open knob and tube insulation. Wire covering of fibrous paper is a promising substitute for rubber sheathing. Slow-drying paints are used in lieu of types requiring quick-drying oils, which are essential in the manufacture of munitions. As a matter of fact, paints and lacquers are eliminated for many conventional purposes. A five-year life span is calculated for many buildings, with stains being applied instead of paint. Stains of creosote, linseed oil, or cottonseed oil are worthy substitutes. Synthetic resins which give body to paints, enamels, and lacquers are eliminated from Army construction specifications. Paint specifications underwent a wholesale revision to conserve pigments requiring critical metals. An absolute minimum of cork is being used in refrigeration equipment. Conductive flooring in ammunition plants now uses domestic graphite and asphalt, thus relieving to that extent the stringency in rubber and copper which such flooring formerly contained.

Services of Supply use substitutes

Concrete, wood, and sheet steel have been going into structures of the Services of Supply wherever they could supplant steel plate. There are now wooden spans in airfield hangars and storage plants; concrete in columns; wood and reinforced concrete in storage tanks. Shower cabinets are made of pressed wood wallboard, as are spray cabinets for sterilizing dishes.

Hot water boilers and heaters are being redesigned with a safety factor that is lower, yet adequate. This will cut by one-fourth the total steel requirements needed for such boilers, with an indicated shift from 2,000 tons of plate to 1,500 tons of sheet metal on projects now in sight. Space heating systems are being changed

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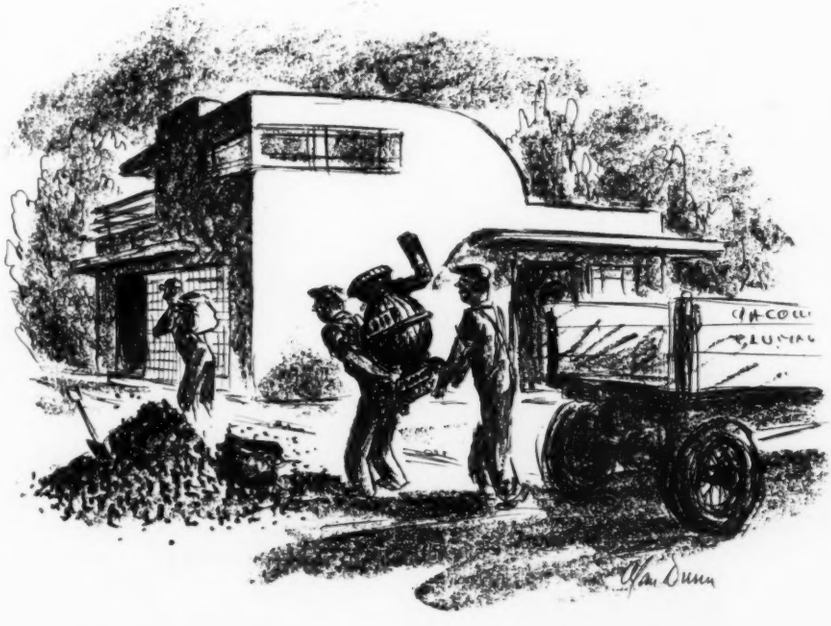

The homes that can't be built today will be better built tomorrow because of these

ANACONDA

NON-FERROUS product developments which promote efficiency and reduce upkeep will always be the fruit of Anaconda's alertness to changes and resourcefulness in research.

In the past two decades, Anaconda's engineering experience accounted for the major product developments you see on these pages. Through them, thousands of homes have been made more livable, more economical. With peace, these products of Anaconda Copper and Brass... and possibly some new companions... will be ready for a booming building industry. 4213

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Introduction and development of the extrusion process for architectural bronze and nickel silver.

1922
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Introduced and promoted Brass Pipe for plumbing. Later developed Anaconda 85 Red Brass Pipe after a nationwide 10 year study of water corrosion.

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1932
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New process makes wide, thin copper available for low-cost, lasting, damp-proofing, weather-proofing and concealed flashing.

The American Brass Company

General Offices: Waterbury, Connecticut, *Subsidiary of Anaconda Copper Mining*

DEVELOPMENTS

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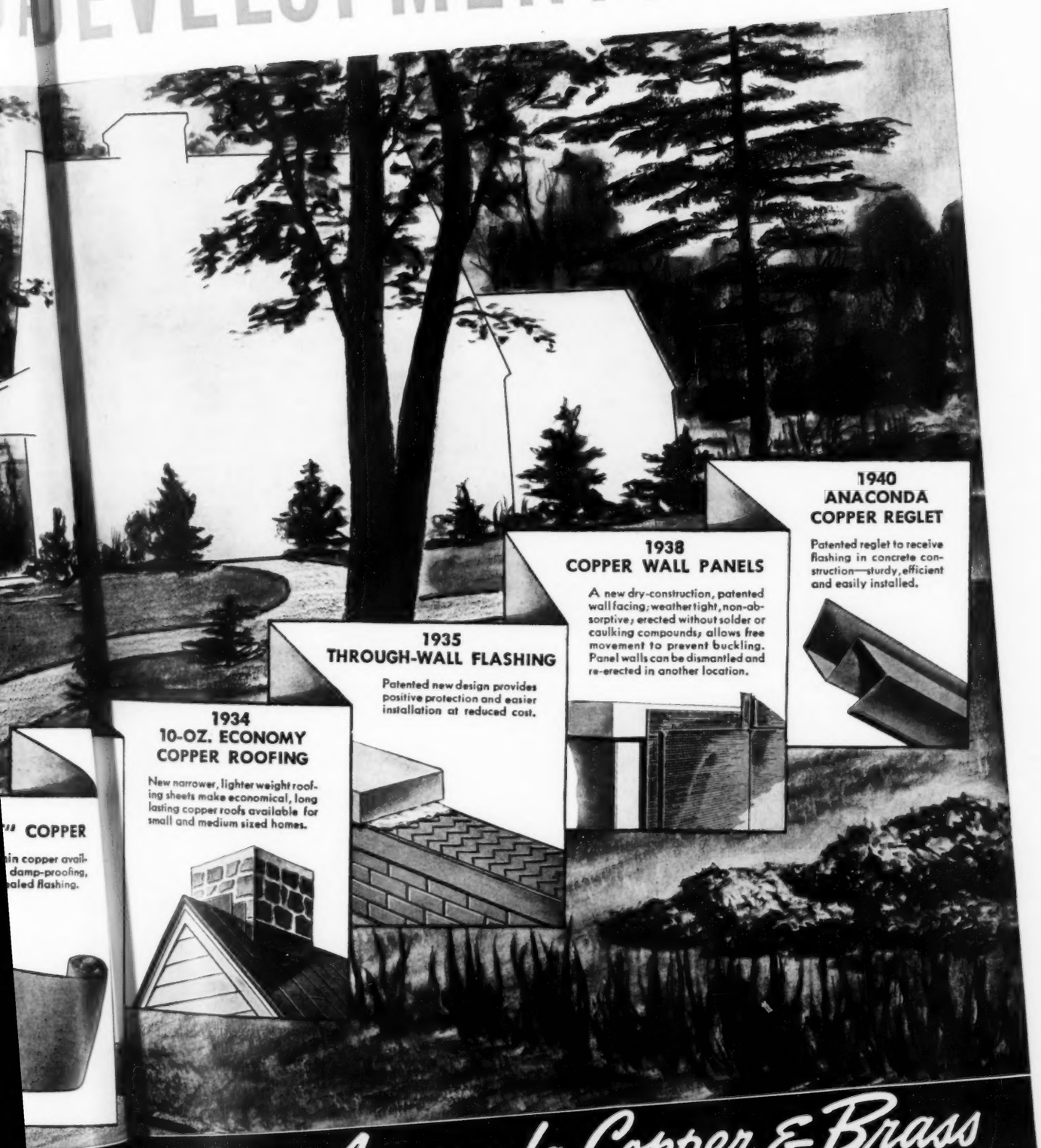

makers of *Anaconda Copper & Brass*

Canada: Anaconda American Brass, Ltd., New Toronto, Ontario

(continued from page 7)

from high steam pressure to low, so that cast iron can be used in lieu of steel plate. Most kitchen equipment is largely of sheet steel or iron coated with porcelain enamel. Substitutions were made long ago on small sizes of utensils. Cooks' tables and pan racks are made of wood. Elaborate dish-washing apparatus is simplified to conserve metal. Stainless steel and monel metal are eliminated, except where indispensable. Jute, which comes primarily from India, has a substitute in twisted kraft paper and cotton braid for caulking pipe lines. Copper screening has been eliminated in favor of zinc-coated steel. A plastic screen fabric, which is apparently superior to metal screening in tropical climates, is also under consideration. Possibly this plastic will also serve in tubing and piping, thus releasing critical metals for other war purposes.

Fuel oil rationing

OPA is studying three possible methods for rationing fuel oil. The first is the heat-loss formula. Engineers will determine the basic ration necessary in various regions to heat a home efficiently. This estimate will be for a home which is well insulated, with a serviceable burner, with proper sashing and storm windows. Basing the ration on a well-insulated house will act as an incentive to insulate and, generally, to get the most out of the fuel oil available. Major objection made is that this is OK when the occupant owns his home but won't work out so well where the occupant is merely a tenant, since the rehabilitation of the home will have to be made by the landlord. With housing at a premium, the landlord is not too much concerned about whether the tenant lives at 55° or 75°. Note that if the landlord converts from oil to coal, he is not entitled to extra rent on the theory that he has made a major capital improvement or is furnishing an added service. OPA's position, a bit unrealistic, is that a landlord is under obligation to furnish heat at any rate, whether by coal or oil.

The second formula is the one currently favored by OPA; it is called the space-heating formula. In this formula no account or allowance is taken for fixing up a home or making it well insulated. You figure the entire cubic space to be heated in the country. You divide this into the amount of fuel oil used for heating and you get the amount of fuel oil used to heat one cubic foot of space. You then cut by a certain amount. The percentage cut now being considered by OPA is 20 per cent. However, an allowance must be made for the fact that last year's winter was several degrees higher in temperature than an average winter. Therefore, the cut being figured by OPA must be, in turn, reduced by 9 per cent to make allowance for an average winter. Then each home owner gets a ration ticket based on the number of cubic feet in his home.

The third method is to cut deliveries to each retailer or distributor by a certain amount, the figure being about 20 per cent. OPA is unfavorably disposed towards this method because it allows too much leeway to the distributor in allotting supplies to his favorite consumer. Therefore, OPA is swinging towards methods I and II for direct consumer rationing.

Bolstering supply

On other fronts WPB, ODT and the Petroleum Coordinator are trying to bolster the supply of fuel oil. FHA and the Federal Reserve Board are pushing to conserve oil by encouraging insulation and conversion to coal. FHA has worked out a program to finance conversion of oil heaters in cooperation with more than 5,000 private credit institutions. Where conversion is not possible, FHA is ready to make available funds for the purchase and installation of a new coal furnace. As an auxiliary measure FHA will push loans to home owners to improve insulation and weatherstripping. These loans are being offered on the most favorable terms possible, with payments on a monthly basis spread over a three-year period if desired. At this point there is no indication of a limitation of conversion by shortage of materials. WPB recently allocated a small amount of materials for conversion purposes. FHA, at least, expects no difficulty from material.

Relaxed credit restrictions

The Federal Reserve Board has relaxed its credit restrictions to facilitate the insulation and weatherstripping of houses and the conversion of oil burners to the use of coal. The credit regulation "W"—which limits the repayment period to a year and sets minimum down payment requirements—has been lifted for these purposes. Those who obtain credit to insulate their homes or to change over oil burners need make no down payment and are not bound by the one-year maturity requirement.

When rent ceilings are raised

Factors constituting a "major capital improvement" on the basis of which landlords may petition for increases in rents were defined by OPA as a structural addition, structural betterment or a complete rehabilitation. A structural addition is a clear addition to housing accommodations, such as the construction of an additional room or a new porch or the installation of plumbing, heating or electricity, where such facilities did not previously exist. A structural betterment is a qualitative improvement, even though such improvement is in part a replacement. Within this latter group would be the modernization of an existing bathroom, or the installation of a modern heating plant replacing an antiquated system. A complete rehabilitation is a general modernization reconstruction such as would make the property attractive in a different rental range.

New lumber order

L-121 has been replaced by Conservation Order M-208. This is a detailed distribution order, listing and classifying permitted uses according to their order of importance. This is the first instance of a new type of limitation order which WPB intends to use generally. It takes a positive rather than a negative approach in that it lists permitted uses. All others are outlawed. Most conservation orders list outlawed uses and all others are permitted. This is a much tighter form of control.

Orders bearing preference ratings of AAA, AA-1 or AA-2 get first call. Orders carrying preference ratings of AA-2X or lower, but higher than A-1-a, come next; those carrying ratings A-1-k through A-1-a follow and

(continued on page 12)

TRAP THE NOISE DEMONS

. . . with ceilings of Armstrong's Cushiontone

IT'S BAD BUSINESS to let noise demons jangle the nerves of restaurant patrons. Those who like to eat in quiet, restful surroundings are all too apt to stay away—as long as these business-killers are on the loose. But it's easy to trap the noise demons with ceilings of Armstrong's Cushiontone—the new material that puts efficient noise-quieting within the reach of modest budgets.

The 484 sound-absorbing holes in each square foot of Armstrong's Cushiontone give it a noise-reduction coefficient as high as .75 in the A3 thickness. Your restaurant clients won't need fine instruments to appreciate the difference this makes when Cushiontone is installed. The effect is positive and pronounced.

Armstrong's Cushiontone is factory-painted, ready to apply to any ceiling which is firm, dry, and reasonably level—in new or old construction. Installation is quick and easy, without undue interruption to business. Maintenance is at a minimum, for Cushiontone is easily cleaned, and can be repainted whenever necessary without affecting its acoustical efficiency in the slightest. Its ivory-colored surface has the excellent light-reflection factor of .73, which helps improve general illumination.

Write for the Facts—Our new booklet gives the whole story of Armstrong's Cushiontone. We should like to send you a copy. Just drop a note to Armstrong Cork Co., Building Materials Division, 1245 State Street, Lancaster, Pa.

Armstrong's Cushiontone

Made by the Armstrong's Linoleum (A) *Makers of and Asphalt Tile*

THE RECORD REPORTS

(continued from page 10)

those bearing preference ratings lower than A-1-k straggle along last.

Delivery of softwood lumber is prohibited unless the lumber is required for use within 60 days, or in the case of green lumber needing seasoning, 120 days. Softwood lumber delivery will be limited to 60 days' supplies.

The order sets forth permitted uses in Lists A, B and C, which cover ratings as follows:

List A, to which preference ratings of AA-2X have been assigned, covers lumber for Army, Navy, government and lend-lease needs; certain projects in the P-19 series; repair and maintenance of Army, Navy and certain other government structures or projects; boxing and crating materials for military purposes; and replacement in inventories of lumber sold for List A purposes.

List B, to which A-1-a ratings are assigned, covers lumber for certain essential uses such as agricultural equipment, automobile trailers, communications, tanks and vats, and scientific equipment; construction of certain defense projects not covered in List A; certain defense housing projects; maintenance and repair of specific types of structures and equipment including industrial plants, railroads, etc.; boxing and crating of chemicals, agricultural implements, and other equipment and materials; and replacement in inventories of lumber sold for List B purposes.

List C, to which A-2 preference ratings are assigned, covers boxing and crating for certain articles not listed in List B; construction of churches, elevators and school buildings when permitted under the Construction Limitation Order L-41; manufacture of specifically listed products; and replacement in inventories of lumber sold for List C purposes.

Postwar building

The idea of a public works preserve and, more concretely, the efforts of Federal planners to get local governments to line up postwar public works projects, at least temporarily, are suffering from lack of funds. The Federal Works Agency and the National Resources Planning Board have been using WPA funds to help municipalities do the preliminary engineering on projects to be undertaken after the war. The small WPA ap-

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THE RECORD REPORTS

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propriation and tight restrictions on non-relief personnel have put an end to this. Nobody has been able to figure out an interpretation of the Lanham Act which will permit use of defense public works funds for this purpose. Senator Wagner's bills authorizing this type of advanced planning—once rejected by Congress—will come back again with more force. The Federal planners will point out that local governments just can't plan a backlog of work projects without Federal help.

Construction machinery

In six weeks or so, anyone who wants to buy a piece of used construction or industrial machinery will find that OPA has compiled a fairly complete catalog of second-hand equipment held for sale either by dealers or industrial firms. The primary purpose of this file is to check on compliance with price ceilings on used machinery, but as a by-product, the catalog will aid in finding needed machinery. Some 35,000 pieces of machinery are listed in the OPA file. They estimate an eventual catalog of 500,000 pieces. WPB will carry a duplicate file and if you are looking for a particular piece of machinery, write to the WPB Priority Section and ask if such a piece is found in the "OPA-WPB Used Machinery Index." Also ask if it is subject to a limitation order. If it is, you have to get WPB's permission before buying it.

Clear plans

WPB is becoming interested in architects, engineers and builders to go over big-job plans with either its Construction Division or Conservation Bureau. The idea is to go in for preliminary discussion with a view to cutting down on critical materials. They recommend studying the list of critical materials in the order of their scarcity, which is put out every month or so by the Bureau of Industrial Conservation, before drafting plans and specifications.

NHA on shortage

NHA just put out a brief formula for beating material shortages.

Standards for permanent and for temporary housing have been issued. Temporary housing will predominate for the duration of the war because

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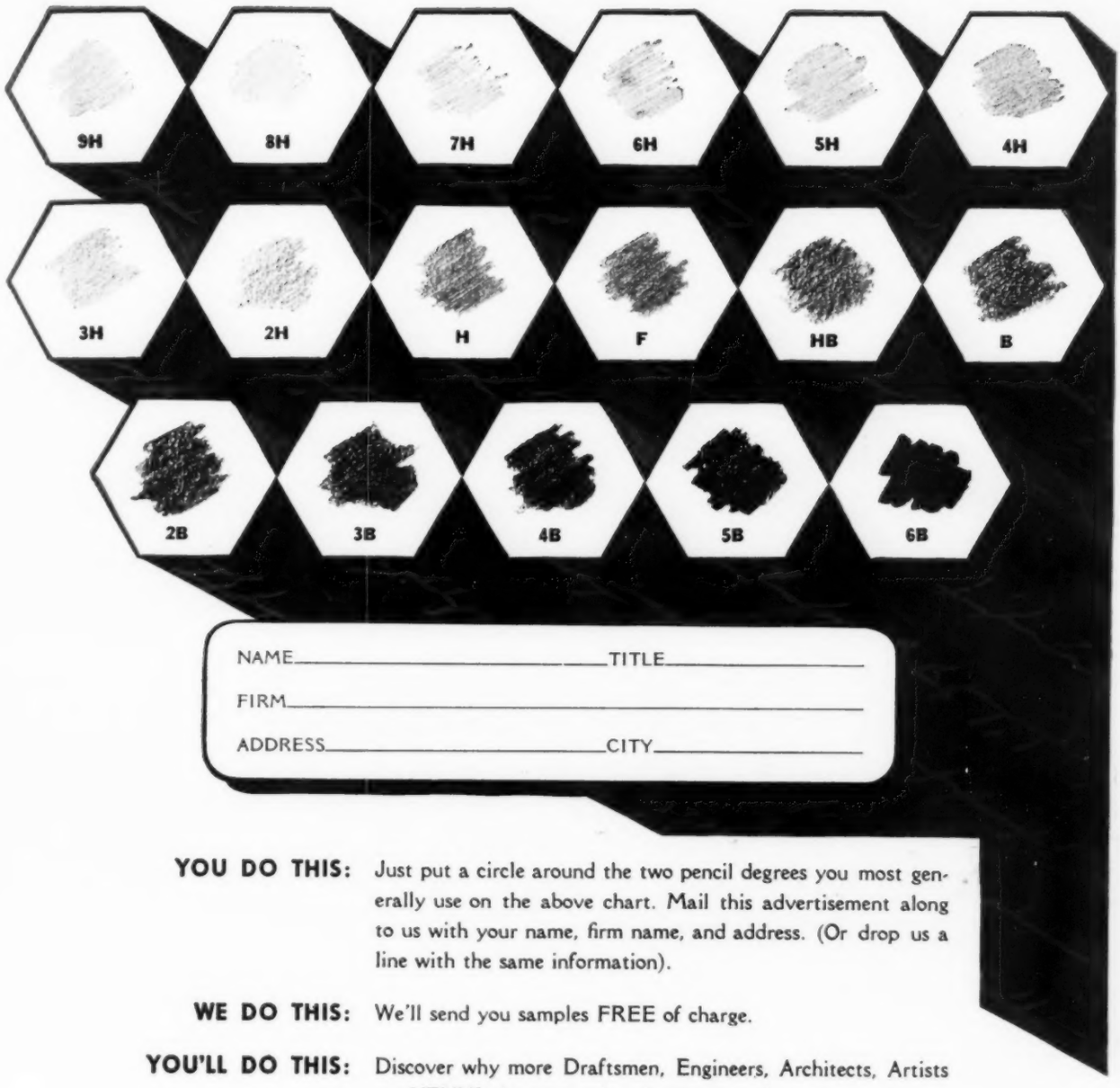

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Discover how smooth and grit-free VENUS lead is. That's because of our patent Colloidal* process.

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THE RECORD REPORTS

(continued from page 14)

of the demands of the war emergency. Temporary housing projects are those on which there is an administrative finding that there was no reasonable prospect of disposing of such housing to meet a need beyond the emergency.

In conserving materials, metals are most critical; lumber next; those putting the greatest strain on transportation the next.

Lumber will continue to be a critical material for at least another year.

NHA points out that many lumber types are available despite the order. Where progress upon a war housing is delayed by the inability to obtain lumber, consideration should be given to the following exemptions from WPB's Limitation Order L-121:

(a) Hardwood lumber. No hardwood lumber has yet been restricted. Such soft hardwoods as aspen, basswood, chestnut, magnolia, willow, yellow poplar and oak can thus be adapted to general use.

(b) Products of small mills. Lumber produced by mills with a daily output amounting to less than 5,000 softwood board feet is not frozen.

(c) Bevelled siding. Use of bevelled siding has not been limited. For economy, bevelled siding in 7/16 in. by 3/16 in. by 6 in. can be made from a 1-in. strip of wood, while the same strip makes only 1¾-in. piece of drop siding.

(d) Retail stocks. Lumber stocks in retail yards are not covered by L-121.

(e) Short lengths. Lengths of lumber measuring less than 8 ft. even among the frozen grades are not subject to limitation.

(f) Low grade lumber. Low grade lumber if carefully culled and selected can in many cases be used for war housing.

(g) Oak flooring. No. 2 and No. 3 grades of end-matched oak floorings are not frozen and should be used instead of soft wood flooring.

New defense housing areas

There have been eight new areas added to the Defense Housing Critical List. These new areas are: Jacksonville, Florida; Lockport, Illinois; Piqua, Ohio; Troy, Ohio; Eagle Pass, Texas; Algoma, Wisconsin; West Bend, Wisconsin; and Waterloo, Iowa (for rehabilitation and conversion purposes only).

(RECORD REPORTS continued on page 92)

STEAM Heats America — at war!

To break the shipping bottleneck . . .

750 new merchant ships in 1942 . . .

1,500 new merchant ships in 1943 . . .

That is America's promise to the Victory Program—and America is going to beat that promise.

It calls for huge new shipbuilding facilities . . . thousands of plants to turn out ship parts and equipment—steel plates, ship fittings, propelling machinery.

Low cost, controlled heat is essential to all-out production. Light, compact equipment is vital for shipboard heating.

Steam is universal for heating at sea because it requires less space and weight than any other heating medium. Steam, harnessed and brought under control with Webster Equipment, is fast, sure, safe and economical.

In this war emergency, Ordnance production has first call on our facilities. But, we are still producing Webster Steam Heating Equipment for use wherever it will help the war effort.

Essential repairs for Webster Systems are available on A-10 priority, under W.P.B. Emergency Repair Order P-84. Orders should be limited to actual needs.

Warren Webster & Company, Camden, N. J. Representatives in 65 principal Cities

Webster
Steam Heating

This is one of a series of advertisements that will tell the public of the part that Webster Steam Heating and the Webster organization plays in the war effort . . . appearing regularly in leading business, industrial, engineering and technical publications.

Charles S. Leopold, Philadelphia, Consulting Engineer. Member of American Society of Heating & Ventilating Engineers, American Society of Refrigerating Engineers. B.S., E.E., University of Pennsylvania.

"Steam is a basic method of heating for other than the simplest structures," in the opinion of Charles S. Leopold, who adds: "Space requirements for generation, transmission and utilization, and first cost lead to this conclusion. Other means of conveying heat have their field of application as a sole means of heating and as an adjunct to steam. In air conditioned structures, where the year-round use of some heat is desired, analysis may indicate the desirability of hot water for booster service. In these cases the use of steam is usually still indicated for the major heaters and miscellaneous standing radiation requirements . . . The development of reasonably priced controlled steam heating has substantially eliminated the objectionable over-heating so prevalent ten or fifteen years ago. Buildings in which controlled heating was installed in the late twenties, still maintain an enviable record for fuel consumption and over-all economy."

Under Mr. Leopold's direction as consulting engineer, the "Controlled-by-the-Weather" Webster Moderator System was installed in 1929 in the 1616 Walnut St. Building, Philadelphia; and since then in the Evening Post Building, New York; 1700 Walnut St. Building, Warwick Hotel and Stern & Company Store, all in Philadelphia.

WARREN WEBSTER & COMPANY

CAMDEN, N. J., EST. 1888, PIONEERS OF VACUUM STEAM HEATING

REQUIRED READING

By ELISABETH COIT, AIA

DESIGN OF MODERN INTERIORS. By James Ford and Katherine Morrow Ford. New York, Arch. Book Pub. Co., 1942. 130 pp., 8½ by 10¾ in., illus. $5.00

THIS is not merely a picture book. The authors, well known for their many-sided work in housing the nation: The monumental "Slums and Housing" of 1936, the 12-vol. report of the President's Conference on Home Building, the several "Better Homes in America" competitions, and the recent companion work to the present one, "The Modern House in America," give us here a keen, analytical study in pictorial form.

Of profit and delight, alike to the reader already appreciative of the "modern" in interiors and to the one who wants to be shown, is the skill with which some 400 photographs illustrate complete rooms, folding walls and partitions, furniture, and other equipment, in the solution of many types of problems ranging from the modest to the luxurious. Plans, dimensions, names of architects, manufacturers, designers, or craftsmen, notes on materials or colors—or all of these—clarify the particular solution, and there is a compact introductory chapter to outline the whole problem of achieving satisfying interiors.

Alan Brown and Ushley Gilbert

Library of house in Lincoln, Mass., G. Holmes Perkins, Architect. From "Design of Modern Interiors"

Margaret Noyes

Facade of the New Block, Lowell, boarding houses built about 1845. From "Mill and Mansion"

MILL AND MANSION . . . Lowell . . . 1820-1865. By John Coolidge. New York, Columbia Univ. Press, 1942. XI, 261 pp., 6 by 9 in., illus. $3.75. (Columbia Univ. Studies in American Culture, No. 10.)

FROM scores of books on American architecture one can trace the evolution of the society which gave that architecture its being. Here is a book showing the inevitableness of a people's architecture as mirroring its life. Lowell is an outstanding example of the early 19th century industrial town, and this study, well illustrated with nearly a hundred photographs and plans, shows the necessity of the town

(continued on page 86)

THEY PLAN FOR THE FUTURE

DESIGN FOR DEMOCRACY.

PLANS for the immediate future center on production for winning the war. Nothing can be built that does not contribute to that effort. Materials are not available for any other purpose.

◆ Yet there will be a future beyond the immediate war effort—no matter how long the war lasts. The winning of the peace will follow. An essential part of winning the peace is the formulation of a clearer picture of postwar plans for producing better environments and higher standards of living. We are fighting for the future, a better future. It is the realization of that fact that spurs the war effort, that strengthens us for the sacrifices that must be made.

◆ Statements of postwar aims, programs for postwar planning should be made now. This is recognized in England. "The necessity for a clearer official statement on postwar aims has been stressed. . . . The energy now being put into the immediate war effort would be vastly increased by such a statement, and a new energy created . . . a definite constructive aim at providing a better social environment for all who have hitherto failed to secure such a thing would give new hope and confidence." So, recently, said W. H. Ansell, President of the Royal Institute of British Architects. The R.I.B.A. is working on a program for reconstruction.

◆ In England also the Secretary of the Planning Department of the Minister of Works and Planning states, "The object of the Government's policy is to secure the right use of the land of the country for all purposes." And further, "It is necessary in all planning schemes to consider not only health and convenience, but the future appearance of town or village. Architectural advice is therefore essential. From an early stage thought must be given to such matters as the practicable size and shape of building blocks, the relation between streets, buildings and open spaces in respect to height and scale, and the appearance of new development seen in association with, or as a contrast to, the old.

"The value of architectural advice taken at an early stage will amply prove itself when rebuilding takes place; and no planning scheme can be regarded as satisfactory, which does not provide opportunities for good building in every area in which building is contemplated."

"Planning and reconstruction of town and country are matters of immense importance to the well-being of the nation. If they are to be well done, early thought must be given to the many problems involved."

◆ Are we more pressed for time, money and men than England? Are we less alive to the needs of the future, even if we have not suffered the bombings they have endured? Are we lacking in the vision that moves our allies to action in planning for a future worth fighting for? Do we lack the courage of our convictions on the necessity of planning now—or have we such convictions? Or are we as a nation (and as architects) going to be caught without galluses or cincture?

◆ The plans being made and the legislation being written to implement the immediate study of city and town improvement deserve the active support of all architects and engineers. This is an opportunity for the profession to demonstrate its capacity for leadership and to prove that it can be "of ever increasing service to society."

Kenneth K. Stowell

EDITOR-IN-CHIEF

GETTING RESULTS WITH WPB

DESIGN FOR DEMOCRACY.

You can expedite your project along the path of priorities to production by observing these pointers from men who have been through the WPB mill

ARCHITECTS and engineers can save themselves considerable time, money and effort and can speed the production of needed buildings by all-out cooperation with the War Production Board from inception of the project. Many a headache, heartache—and worse, the loss of valuable man-hours of war production—can be saved by observing a few simple rules:

1. Know what kinds of building are permitted under WPB.
2. Become familiar with all the rules, regulations, orders, procedure and documentary forms that must be employed before you start a drawing.
3. Know exactly what materials you think you must have for the job, whether a new building, an addition or a remodeling.
4. Use utmost ingenuity to eliminate every possible ounce of critical material from your project.
5. Ask questions of WPB before proceeding rather than get into difficulties and delays by not knowing your ground. Before asking, however, make sure the information is not already covered in printed orders, and regulations or critical lists.
6. List for WPB the type, size, weight, quantity, cost and use of all critical materials you think you must have. The list should be an itemized breakdown, not just so many tons of steel or pounds of copper. Be specific.
7. Before making any actual working drawings or filling out and filing the application form, go over your project, personally if possible, with the appropriate WPB office. A discussion of your problems with the WPB and its Division of Conservation in New York or in Washington will disclose many things you cannot do and will suggest solutions and substitute materials that will save both time and delay.

From your preliminary rough sketches and lists of materials, WPB experts will put you straight on the path to working-drawing production, and no elaborate drawings will have to be junked because you went ahead on your own only to find they did not meet the requirements. Accepted architectural and engineering practices must go by the boards to conserve the critical materials for their most essential uses. Consult the Division of Conservation for their latest suggestions regarding both materials and methods of construction and equipment. (We assume you are familiar with "The Conservation of Critical Materials in Construction" issued by the Cooperating Committee of the American Institute of Architects and the Producers' Council, Inc.).

You will then be in a position to speed your working drawings and to fill out the necessary forms completely and accurately. You may not get approval for all of the material you request, but be sure your list is complete, as you will not get any material not called for on your application form. This will save both your time and the time of the WPB experts in putting through the proper Preference Rating Orders and Certificates.

Essential documents:

First, read the "Directive for Wartime Construction," issued by the War Production Board and the War and Navy Departments. This is the general covering order which describes what can be built. If your project does not meet the requirements as here listed, postpone it until after the war.

Next in order of importance for your thorough understanding is Number L-41 (deferring certain classes of non-essential building). Familiarity with this document is a "must." In its "Schedule A" it lists the preference rating orders for various types of permitted construction and also the proper application form which must be used for each type. A careful reading of L-41 discloses that certain types of civilian building can be done without priorities, such as maintenance and repairs, residential construction costing less than $500 in any one year, all other types of civilian construction up to a maximum of $5,000 in cost.

A supplementary conservation order, Number L-41, assigns high preference ratings on low-cost remodeling projects in defense areas, provided the cost of critical materials does not exceed an average of $100 per room for each dwelling unit, or more than $800 for each structure.

Plumbing and heating equipment use so much critical material that they are covered by the special limitation order, L-79, with which, in its amended form, every architect and engineer must be familiar. This order stopped the sale and delivery of many types of heating equipment.

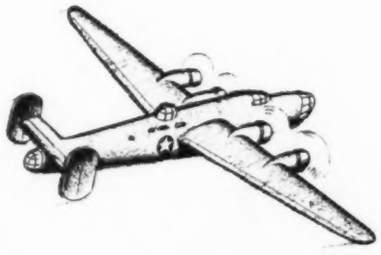
If your job involves housing for war workers, you must consult and observe the "Defense Housing Critical List," which describes all the materials and equipment for which you will need priorities. Be sure that you are on the list to receive all new rulings or amended old ones from WPB.

See our Washington news letter each month. In this issue, for instance, the New Lumber Order L-121 is discussed, as well as other late rulings.

To summarize, know what you want, know what WPB wants (through familiarity with their orders) and consult and cooperate with them from the earliest possible moment. Then both you and WPB will be doing the one all-important job—speeding the war effort.

Hedrich-Blessing

WILLOW RUN BOMBER PLANT



Albert Kahn
Associated Architects & Engineers, Inc.
Ford Motor Company Engineers

By now it is trite to state that the urgency of the war task has produced industrial miracles. And yet, confronted with this greatest of all the new bomber plants—a plant that only a year and a half ago was just an idea on paper—with its magnitude and swift construction, miraculous seems the only appropriate term. In fact, of course, it is not. It is the product of complete collaboration between alert production minds, architects and engineers geared to the terrific pace of war construction, and contractors who carried through the project on schedule. Three times during construction, the production order from the government was stepped up sharply, and three times the plans were changed to meet the new demand. Today the finished structure stands as a gigantic symbol of our determination to win the war in the shortest possible time and to establish and make real our new concept of Freedom and Democracy which is the expressed purpose of the struggle to which we are dedicated.

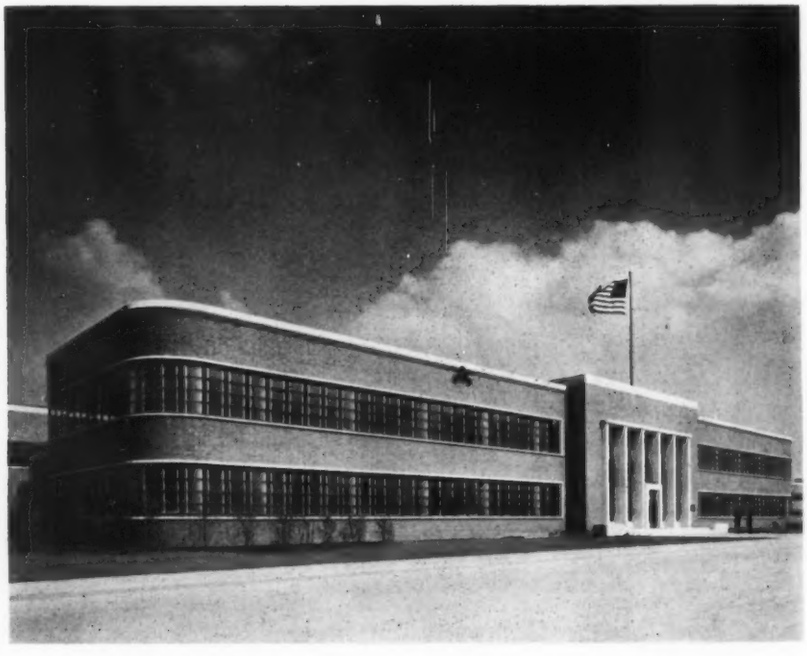
ORGANIZATION

DUE TO WAR censorship, information as to placement, size and operation of the various buildings that make up the vast plant is not available; but a general description of the main units may be of interest. The factory proper is, of course, the major unit, with hangar building and test field adjacent.

The factory is of the semi-blackout type, with no daylight in production areas. Exterior sash light and ventilate only office and utility areas.

A vast precision tool in itself, the factory is so organized that raw materials enter at unloading platforms, sub-assembly operations fabricate parts in adjoining areas, and these are all coordinated to feed into the main assembly lines, at the end of which finished bombers roll out onto the test field under their own power.

The final assembly lines occupy bays with clear spans extending the length of the building. Sub-assemblies and other operations take place in adjacent bays. Aisles between work lines are 12 ft. in width and



ADMINISTRATION BUILDING

Typical of the accessory structures that serve the huge plant, this two-story building houses the administrative and business offices. Of reinforced concrete construction, the building has finish walls of face brick with stone trim. In the office area, partitions are standard stock type; floors are surfaced with linoleum, and ceilings are acoustically treated. In the main lobby, terrazzo is the floor surfacing. The building is year-round air conditioned.

are serviced by standard automobiles and motor trucks, cranes and conveyors.

The hangar building houses a first-aid department, flight hospital, pilots' training school and offices. Hangar doors are of the overhead type and electrically operated.

Secondary structures, connected with the main factory by bridges, include the two-story Administration Building (facing page) and a Training School, also a two-story structure. The connecting bridge gives the school—which contains classrooms, laboratories and a large lecture room—actual connection between theory and practice.

A Personnel Building at the entrance to the plant serves also as the traffic-control point; a gate serves bus and auto arrivals and departures, and a passageway is provided for pedestrian employees and visitors. Other units of this building are interview rooms, a medical-inspection department and write-up, identification-photograph and fingerprinting rooms.

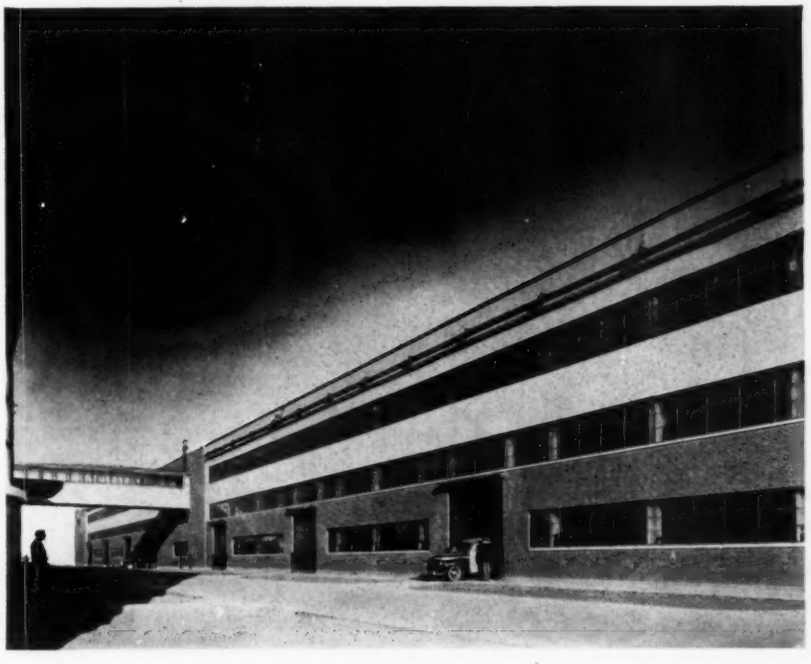
In addition to these buildings are many small, special-purpose structures—a commissary, powerhouse, garage, storage sheds, etc.

Bridge connects Administration Building and factory

CIRCULATION

THE PARKING area is across railroad tracks from the factory itself. Employee entrance and exit is handled by a series of towers which connect by overpass to the mezzanine level of the factory where washup and locker rooms are located. Access to work-station points is by means of stairs both near the building perimeter and at the center. This system enables workers to reach their respective positions without cross traffic.

An interesting feature of the tower-and-overpass device is that it is also a part of the commissary system. Instead of a central cafeteria, a lunchbox system of serving



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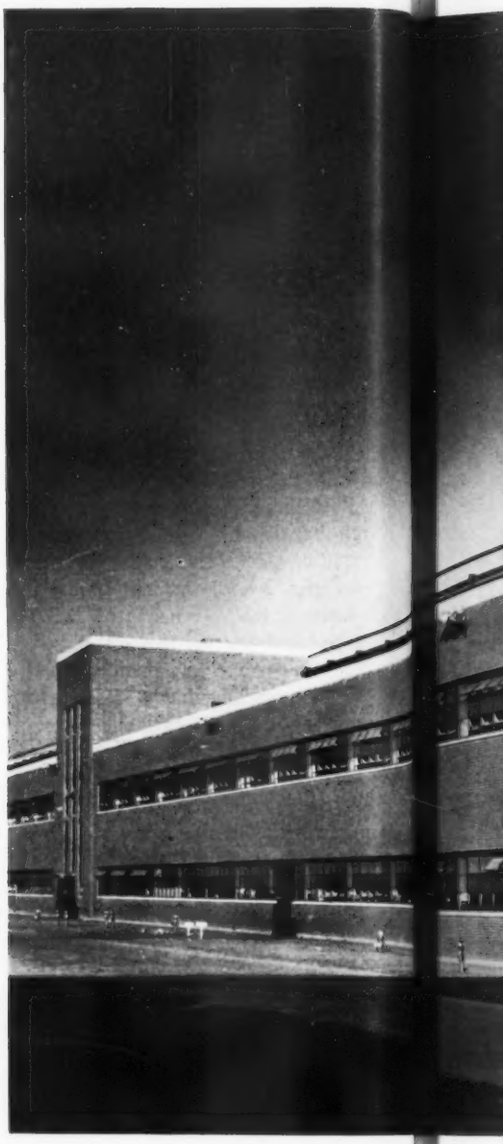
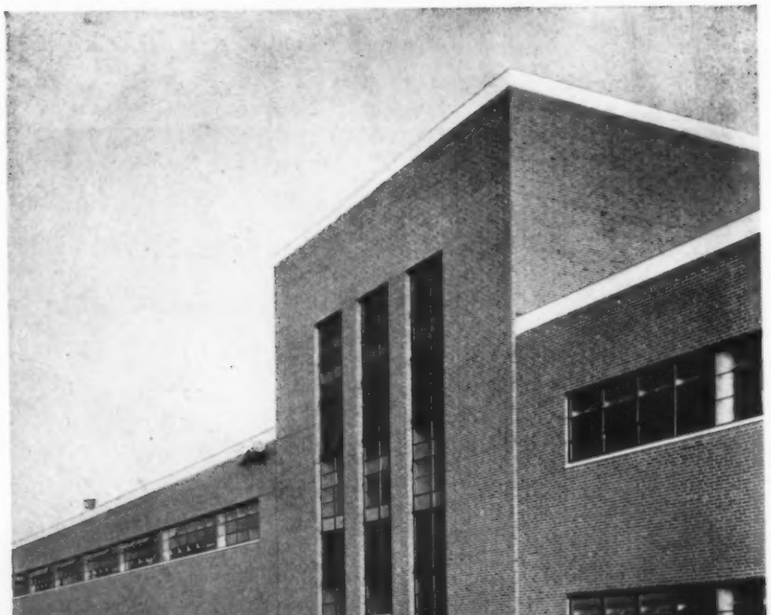
Bridge between the Training School (left edge of photograph) and main factory





meals is employed, avoiding the heavy traffic problem of a central eating place. At lunch periods, lunch wagons are brought from the commissary building to the entrance towers, hoisted in special elevators, and rolled across the bridges, where the individual boxes are distributed to the workers who use this station point.

STRUCTURE

THE MAIN factory is framed in steel. Initial portions utilized members specially made up from limited sizes and shapes which a local concern happened to have on hand.

The envelope is of face brick with sand-lime back-up brick. Upper portions of walls of certain units—such

as the hangar block—are of gun-applied concrete. Steel sash are used throughout.

The roof is of 16-gauge, enamel-dipped sheet steel, covered with insulation, 4 plies of asphaltic felt membrane and hot pitch and slag. Factory floors are concrete-slab construction, reinforced with two layers of wire mesh and surfaced with 2½-in. creosote wood blocks.

HEATING, VENTILATING AND AIR CONDITIONING

VARIOUS types of systems are used in the different areas. Steam for heating is supplied from oil-fed boilers in the boiler house. The steam is piped through a tunnel across the main building, with branches running

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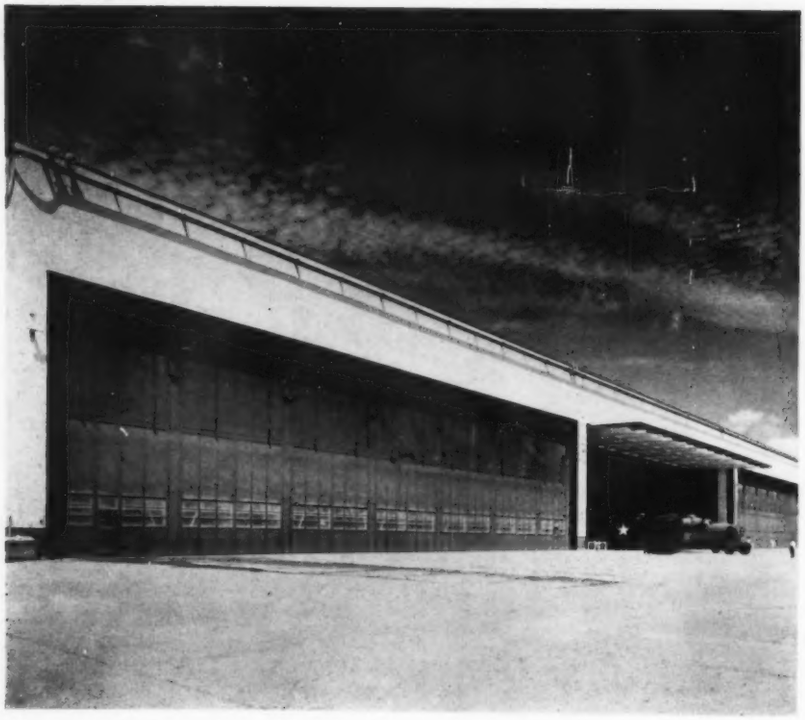
Overpass employee entrance



the entire length of the building and to the several other buildings. All condensate flows into pump and receiver units and is pumped back into a receiver in the power-house.

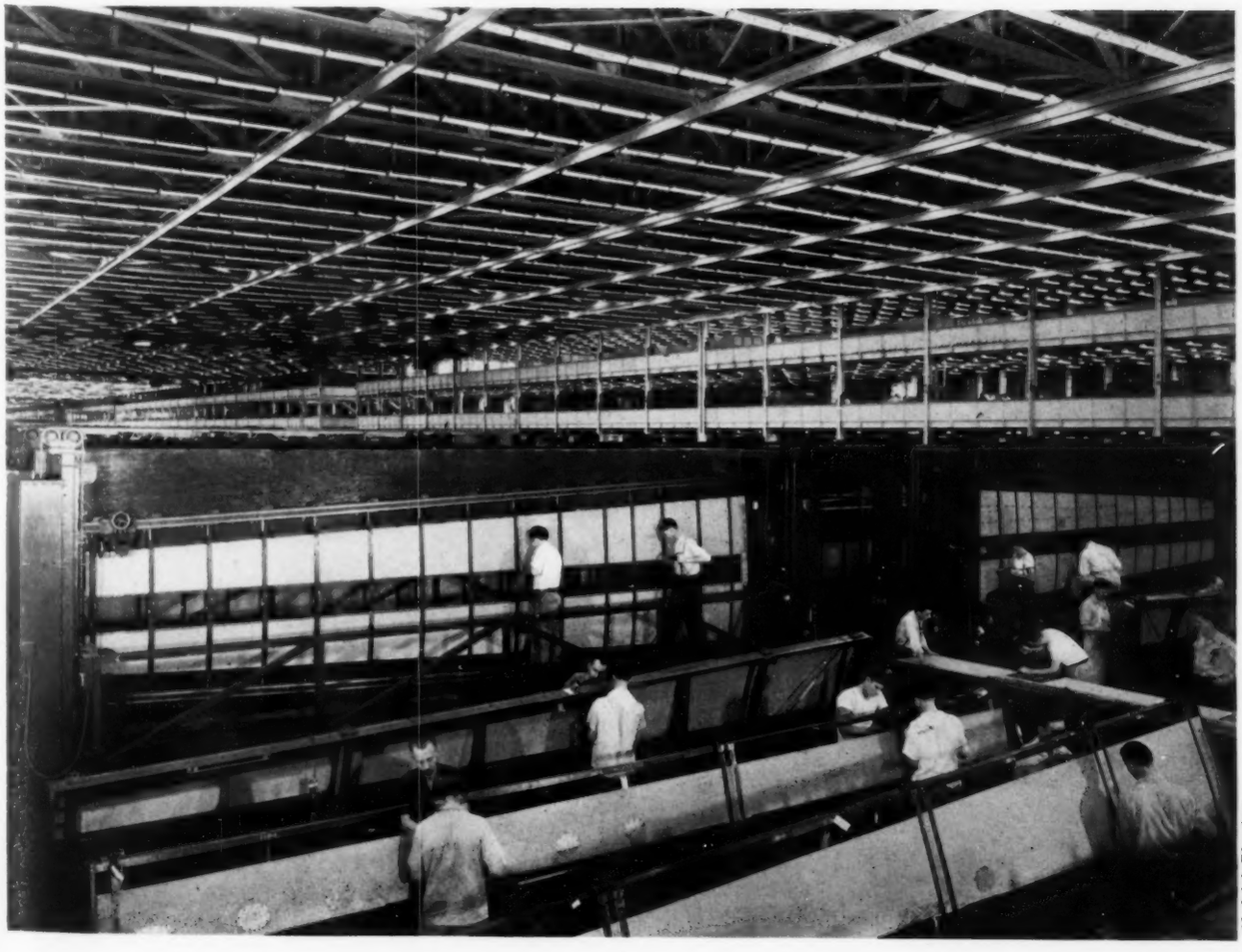
A hot-blast system is used in the factory, and a combined hot blast and radiators are used in the engineering section. Fan rooms are equipped with units with two-speed motors. The hot air is distributed through duct work located in the truss space; temperature is governed by thermostats.

Using low-speed in winter, the system supplies approximately two complete air changes per hour for the total height of the building.

In summer, the high speed is used, and the system is supplemented by roof exhaust ventilator fans to provide about 4 changes of air per hour for the entire building height, or ten changes at 12-ft. height.

In offices, operating rooms, laboratories, wards, etc., radiators are wall-hung convectors with sloping grilles in the top.

The whole system is designed so that future cooling equipment can be added to any area or in the entire building group. At present, cooling is employed only in the administration building, engineering laboratories, drafting rooms and certain special-purpose rooms.



Hedrich-Blessing

Engineering drafting room

Conference room

Hospital and first-aid facilities

WIRING AND LIGHTING

POWER is brought to the plant by separated utility lines, from which it is distributed underground to a series of underfloor plant substations. All bus sections are inter-connected by means of an emergency tie bus so that power may be supplied by either utility service to any bus section in case an outage should occur. In addition, turbo-generators on the bus sections can be synchronized with the utility lines and paralleled with either. All substation transformers for both power and lighting are interconnected on the secondary sides. There are no overhead conduit or bus systems in the plant, and the underground system is so designed that in case of damage only the relatively small area served by the damaged part would be cut off —and that, only temporarily.

Lighting is of the fluorescent type throughout, the current supplied by underground feeders. In the general assembly area, which is wholly artificially lighted, units are mounted end to end in continuous rows on approximately 10-ft. centers at a height of 36 ft. The maintained intensity on the working plane is 30 foot-candles or more.

Hedrich Blessing

POSTWAR POTENTIALS FOR BUILDING

By THOMAS S. HOLDEN, President, F. W. Dodge Corporation

THE CONSTRUCTION MARKET today is a dual market comprising the current market dominated by war construction and war production and the future market being built up by current postponement of buying and by the expected emergence of new needs, new products and new opportunities for business expansion.

The deferred construction market came into being on October 9, 1941. That was the date when SPAB (the old Supply Priorities and Allocations Board) issued a policy statement declaring that priorities for scarce materials would not be issued for any public or private construction projects except those essential for defense or those essential for civilian health and safety.

Development of the deferred construction market was accelerated by Conservation Order L-41, issued by the War Production Board, forbidding new construction projects except those essential to the war, those essential to civilian health and safety and certain other specified types of small operations.

The effect of these orders is shown in the decline of private construction contracts since October, 1941 (see chart).

The decline in private construction contracts since October, 1941 was solely due to these restrictive orders. Since industrial production, national income and every other index of business prosperity have increased continuously, it can be said with certainty that private construction contracts would have continued on the upgrade if it had not been necessary to give war construction the right of way by ordering deferment of nonessential projects.

It is possible to obtain a rough estimate of the accumulating volume of deferred work.

If unrestricted, private construction contracts might have continued on the upgrade to reach a rate of $3,000,000,000 a year by the end of 1942; actually, it may get down as low as a $1,500,000,000 annual rate by December 31. This would leave a theoretical gap of $1,500,000,000.

This would represent only a portion of the deferred work because many public projects of the customary types for civilian use have also been deferred. Furthermore, the contract figures are recorded for the 37 Eastern states, and a sizable figure should be added for the 11 Western states.

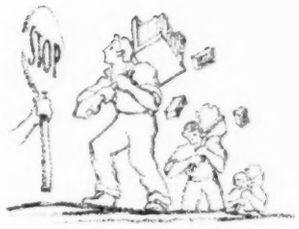
Allowance for these two additional factors makes $2,500,000,000 a reasonably conservative figure for the deferred demand in the entire country as of the end of this year. Naturally, this is a broad sort of estimate and not an exact measure; but it indicates the existence of a continually growing volume of deferred demand.

Consequently, this chart illustrates two markets: 1. The war construction market, which is still rising; 2. The apparently declining private construction market, which is actually a postponed market and not, as the curve would ordinarily indicate, a market that is dwindling because demand is declining.

The deferred construction market consists, actually and potentially, of all types of projects that cannot be undertaken today, such as: residences over $6,000 (including land), apartment buildings, hotels, theaters, hospitals (for civilians), educational buildings, commercial buildings, industrial plants (for civilian goods), public improvements, etc.

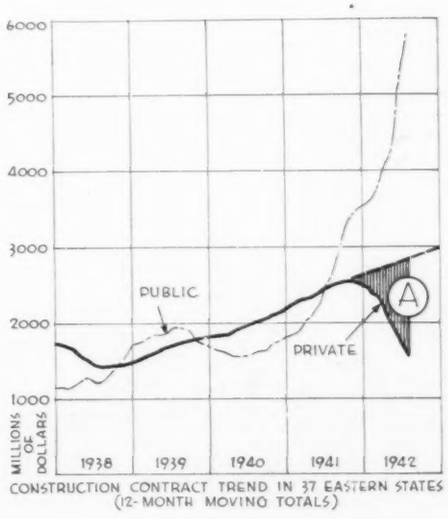
Added to the deferments occasioned by war restrictions there will also be improvement projects by railroads, public utility companies and many other industrial organizations which were deferred during the long depression preceding the war.

After World War I, it took until the end of 1924 to make up shortages brought about during the war period. However, the postwar recovery of the early 1920's was interrupted during a period of nearly two years by a postwar



CHAMBER OF COMMERCE OF THE UNITED STATES ***(in Washington Review, its weekly bulletin):—"Government leaders, from the President down, are looking to the time when the task of rebuilding a shattered world is taken up.***

"Business, too, is looking ahead. A special committee of the Chamber of Commerce of the United States is giving earnest attention to the part that business will play in that vast undertaking."



Shrinkage of private non-essential building (area A) represents a tremendous and ever-growing post-war building market

price inflation (1919 and early 1920) and a consequent deflation accompanied by a severe depression (1920 and 1921). So, the deferred demand was enough to cause a rising construction trend for a net period of three years.

The amount of deferred construction demand that will accumulate during World War II will obviously depend upon the duration of the war; that is, upon the number of months during which nonwar construction is restricted. The volume of accumulated demand at the time of removal of restrictions, plus the question of whether a postwar price inflation similar to that of 1919-1920 will this time be avoided, will determine the period of that part of the postwar recovery which will result from deferred construction demand.

NATIONAL ASSOCIATION OF MANUFACTURERS:—*"Now is the time to plan for the postwar readjustment period, to establish present and future policies which will permit and encourage the highest degree of postwar productive effort and the largest amount of postwar employment and wages —as high as postwar conditions warrant—all with the objective of contributing, so far as it is possible to do, to the postwar economic prosperity and reconstruction of the United States." Committee on Postwar Problems.*

DAVID C. PRINCE, *Vice-president, General Electric Co.:—"A detailed analysis shows that it should be possible by keeping the country busy and employed, to make full use of our expanded productive machinery and provide a high standard of living for all America. The only way we can fall short of the goal is to sit down and not arrange to have work for those people to do."*

Will Construction Activity Expand After Deferred Demands Have Been Met?

1. Historical Background: After World War I deferred construction demands had been substantially met by the end of 1924. Following 1924, however, construction demands did not fall off, but increased greatly, producing four record-breaking annual volumes (1925-1928).

New construction demands arose in connection with a great wave of economic expansion. This was a many-sided development, but perhaps its most important phase was the expansion of the automotive industry and allied industries (rubber, petroleum, etc.).

The automotive industry, by developing cheap cars and installment credit, created a revolution in transportation. This expansion demanded factories, service stations, filling stations, private garages, hard-surfaced highways, etc.

It enlarged the daily cruising radius of the average man three-fold, from 5 miles to 15 miles. This meant that the effective area of urbanization increased nine-fold, from less than 80 square miles to more than 700 square miles. Commercial and industrial prosperity was bringing people to the cities and the cities were overflowing into suburbs and outlying commuting areas. These population movements created demands for various types of construction.

The record-breaking construction volume and the general prosperity of the late 1920's accompanied a great wave of economic expansion.

2. The Nature of Construction Demand: Construction demand arises from two important sources: a) needs for replacements, modernization, repairs; b) needs for new facilities.

The first category of needs is always present even in a static economy or a depression period. It employs the construction industry on a moderate scale only.

The second category of needs arises when new developments encourage vast investments of capital in new facilities—facilities for industry, trade, family and community life. Expansion periods are periods of prosperity and full employment of the construction industry.

3. Potential Expansion Factors: It is almost impossible to measure in advance the significant developments that make for general economic expansion. People were skeptical about the first steam railroads; the early automobiles were rich men's toys. Few people knew in 1919 what the automotive industry would accomplish in the following decade. In the deep depression that preceded these and other tremendously vital expansion factors, people were very pessimistic, freely predicting long periods of stagnation and distress; up to now people have generally not been able to forecast what the next big expansion factor would be.

However, a period of great business and construction activity, in which shortages are made up after an extended period of stagnation or postponement of buying, builds up national income, savings and investment confidence, thus paving the way for expansion.

So, when the deferred demand for construction and automobiles and household goods and machinery for peacetime production has been taken

care of in the coming postwar period, the stage will be set for expansion. In order to carry our big debt load, to maintain reasonably full employment, and to utilize our vastly improved and augmented industrial plant capacity, government will be obliged to adopt policies that will encourage wide-scale investment in new enterprises.

A. Revival of the Automotive Industry: The transformations in our modes of living and our community patterns wrought by the automobile have not been completed. Much is yet to be done in developing bus and truck terminals, hard-surfaced highways, revamping street and open-space patterns of cities and towns.

B. Aviation: Commercial aviation, including fast freight service, is due for a vast expansion; the private plane may become a really important transportation factor. Whether this development in transportation, practically certain to come on a large scale, will become as great a stimulus to general industrial and business expansion as railroads and automobiles have been remains to be seen. In any case, hangars of many varieties and sizes, airports, passenger and freight terminals and many as yet unknown accessory buildings will be required.

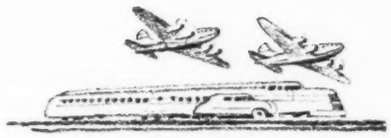
C. Light Metals and Synthetic Materials: War needs have caused enormous expansion of aluminum production; they have practically created a magnesium industry; they have brought into being new plastic materials and expanded production of others; they are creating a synthetic rubber industry. Producers of all these materials are at this moment conducting product and market research in peacetime uses of these goods. These materials will be used in industrial products, airplanes, automobiles, household conveniences, art objects and in many other ways. Their development as structural materials may conceivably revolutionize construction methods, architectural styles and furniture design. It is very difficult to see any limits to the expansion possibilities of these materials newly available in vast quantities at low prices.

D. New Construction Materials and Methods: New materials and new construction methods, producing greater values per building dollar, will inevitably increase demand for low-cost buildings of every classification, particularly houses. War construction requirements, with the paramount needs of speed and economy in use of scarce materials, are daily modifying traditional design ideas and construction procedures.

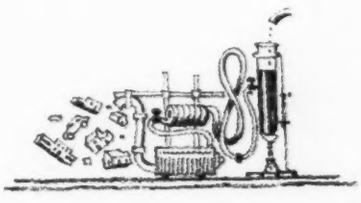
Among other things, the makers of prefabricated houses have for the first time found in the war housing program quantity orders for houses, creating an opportunity for practical development of techniques and demonstrations of potentialities that did not hitherto exist. Undoubtedly, such developments will have some lasting effects upon construction methods and procedures; though the importance of the prefabricated house itself as a factor in the future housing market is still problematical. It will probably depend more upon future possibilities of quantity orders for houses in reasonable continuity than upon technical developments.

In any case many of the technical developments of the war period will persist. To the extent that they will provide better buildings for less money, they will contribute largely to expanding the construction market of the future.

E. Housing: The housing revival of the late 1930's, interrupted during the period of war restrictions except for buildings in the war housing classification, will doubtless be resumed. In part, the housing program will make up deficiencies of the last depression period; its continuation will depend upon the degree of general prosperity (high national income and full employment) the country will enjoy. If national income averages over 100 billion dollars annually in the 1940 decade, as seems highly probable, housing demands will be very great and will continue for an extended period. There will be a much greater demand, proportionally, for houses to cost (with land) over $6,000 than in the 1930 decade; not only because there will be some surpluses of lower-priced houses directly after V-day, but also because higher national incomes mean more families moving into higher income brackets and demanding better houses than they lived in before. The



SUMNER WELLES, *Under Secretary of State (Memorial Day, 1942):*—"*. . . . I believe that here in our own country we will continue to find the best expression of our own and the general good under a system which will give the greatest incentive and opportunity for individual enterprise. It is in such an environment that our citizens have made this country strong and great. Given sound national policies directed toward the benefit of the majority, and not of the minority, and real security and equality of opportunity for all, reliance on the ingenuity, initiative and enterprise of our citizens rather than on any form of bureaucratic management will in the future best assure the liberties and promote the material welfare of our people.*"



HERBERT HOOVER, *Ex-president of the United States:*—*"In the last war we made little advance preparation to cross the precipitous mountains of after-war disorganization or of methods to recover the lost freedoms. We were then ignorant of what lay ahead. We know more about it this time. We need to think out economic reconstruction. We must think out the recovery of freedom. And that preparedness can come only from organized objective research and public debates. It must come from many sources and many places and not from government alone. It is a safe area for vigorous speech."*

LEWIS H. BROWN, *President, Johns-Manville Corporation:*—*"We are, after all, only a little way across the threshold of the technological age. We will need to rebuild America to fit the tempo of the airplane just as we rebuilt it after World War I to fit the tempo of the automobile. Our greatest obstacle is that we have not yet learned how to couple government fiscal policy and the productive genius of American industry to provide full employment—This goal is not impossible."*

expanded housing market will be largely a market for private builders and investors. The possible extent of any government housing program is purely conjectural at this time.

F. Urban Redevelopment: Redevelopment of blighted urban areas, talked about a great deal during the past decade, is more than likely to develop into real large-scale programs. A number of people are advocating that this should be done on a national scale, with subsidies for local communities by the Federal government. Other people, equally impressed by the necessity of doing this job on a large scale, believe that it can be done and done more soundly through local initiative and private investment; to this end four states (New York, Illinois, Michigan and Kentucky) have enacted enabling legislation to encourage private initiative and private investment.

Since these state enactments were all passed shortly before the dimout on private construction, projects planned to function under them have not materialized; consequently, it is still an open question whether the job can or will be done with local initiative and private capital without Federal financial aid. Under one method or another the job will undoubtedly be done. Urban redevelopment would create large-scale projects including housing, commercial and industrial buildings, open spaces, public facilities, etc. Some projects would call for immediate demolition of old buildings and replacement with new ones; some would combine modernization of existing buildings, new construction and gradual replacement of old buildings over a programmed period. The urgent necessity for urban redevelopment is based upon the need to restore the balance between central districts and outlying areas, to recreate real estate values, strengthen the security underlying mortgages and improve the financial status of cities.

G. Public Works Reserve: Federal, state and local governmental agencies customarily responsible for planning and executing public improvement projects have been obliged, like private investors, to postpone those projects of civilian character which would, under other circumstances, have been carried out this year. Regular improvement projects postponed during the war period thus became part of the deferred construction market.

These agencies, however, are now engaged in developing long-range programs for projects to take care of the future needs of their respective communities. They have been encouraged to do so by the Federal Works Reserve, a unit of the Federal administration set up under the joint auspices of the National Resources Planning Board and the Federal Works Agency, whose field representatives have made contacts with state and local government agencies, helped them to study their financial resources, set up capital budgets and develop long-range programs for future community improvements.

Up to this time 35 state governments, 270 counties, 755 municipalities (ranging from quite small towns to some of the largest cities), 63 independent school districts and education boards, and 18 other local jurisdictions have started long-range programs. Some of these are in the preliminary study stage, some fairly well along, some in the stage of completed programs formally adopted, some with appropriations for preparation of blueprints and specifications. For example, the State of New York has set up a Postwar Public Works Planning Board, with a special appropriation of $450,000 (to supplement funds available in the budgets of various state agencies) for preparing plans and specifications; the City of New York has appropriated something over $22,000,000 for preparation of plans and specifications for future projects with an estimated total construction cost of $660,000,000.

It is today an open question as to whether these projects will go ahead entirely on the basis of local financing, or whether there will be a program of Federal aid and, if so, how much. Solution of that question will depend on two important factors:

1. The capacity of states and local government agencies to finance their improvement needs out of their own tax and credit resources.

2. The extent of any future unemployment emergency that would be of a character to demand emergency legislation by Congress.

(continued on page 90)

How long will Willow Run workers fight for seats on the busses? How long will busses continue to run? With almost no new housing ready in the whole area, the army of bomber plant workers must commute over long distances or live in trailers or tents. How long will housing be delayed?

WHAT HOUSING FOR WILLOW RUN?

Questions of Priorities and Pipe, Politics and Personalities, Policies and Production Programs, Water and Walking Distances, Town Lines and Party Lines, Time and Tires Muddle Thinking and Delay Effective Action. Time is Short, Houses Lacking.

THE Battle of Willow Run still rages on the home front after many months, with housing for bomber plant workers making virtually no progress at all. Casualties have been heavy—mostly in burnt fingers—and housing is caught in a cross-fire of propaganda. Meanwhile the thousands of in-migrant workers for the greatest of bomber plants are left to find such accommodations as they can—trailers or tents or shacks. The alternative is to spend long hours and consume untold quantities of gas and rubber commuting from Detroit, a city already crowded to the bursting point.

It is clear that design and construction problems are the least of the issues that have so long kept things at a shameful impasse. Even priorities problems have been waiting on the settlement of issues that seem still more critical than material shortages. The drama of Detroit has about all of the characters and plot complications that could possibly be crowded into one pageant, and is different from many less spectacular war housing productions only in degree. And if war housing does have any relation to war production, it is obvious that this prolonged struggle is not bringing V-day any closer.

First act of the drama began more than a year ago, when the mammoth plant was planned for an open field 25 miles west of Detroit. That was before Pearl Harbor, and perhaps there was much logic in placing the plant out in Washtenaw County, away from the congestion of Detroit, and away from its mercurial atmosphere. Whatever thought was given to the housing of its thousands and thousands of workers perhaps did not contemplate troubles in tires and building materials and utility services. Granted that these shortages did arise to thicken the plot, the fact remains that the drama has taken more than a year to get only through the second act.

Delay is certainly not due to lack of schemes or plans for housing. Nor is it due to any lack of willingness on the part of either private builders or public housing officials. Private builders say they are willing, indeed anxious, to supply all of the housing required, in any part of the area. National Housing Agency has given intensive study to the whole situation, and has plenty of plans of its own. The most spectacular, and most argued, element in its plans calls for a permanent and complete new town of Willow Run, the so-called Bomber City. It has also announced other plans, including less spectacular public projects and various types of "duration dormitories."

Priorities clearance, necessary to either government or private enterprise, has been repeatedly delayed. Besides considerations of actual material shortages, which in themselves have caused revisions of plans, other factors are gasoline, tire and other transportation difficulities, lack of utilities and services to the areas proposed, confusion over the number of workers to be housed, and continual changes in housing proposals.

All of these matters have been argued interminably. Plans for the new town have been bitterly opposed—by farmers, builders, real estate men, local citizens, and especially by Ford officials—until the whole situation was investigated jointly by the Truman Investigating Committee of the U. S. Senate and the WPB.

Currently the Bomber City scheme is being held for further study, but other portions of the NHA plans are recommended for approval. Also clearance is being arranged for privately financed projects. As one reporter puts it: "WPB is definitely putting the heat on NHA to adapt its public housing program to use improved land in adjacent communities. The club being held over NHA is an increase in the number of private housing units and a corresponding decrease in the public housing program unless this adjustment can be made."

THE BATTLE OF BOMBER CITY

OPPOSITION to the new town of Willow Run (Bomber City) may or may not be fully explained by the arguments presented in the Truman Committee investigation. Those arguments dealt with water supply problems, transportation difficulties, cost to government, material shortages, possibility of a future ghost town, vulnerability to bombing, and so on. But in-the-know observers say that while the opposing forces speak of these things their ultimate concern is deeper.

Anybody working in housing must face the social and political implications of a completely new town dropped suddenly in the midst of any active area. As originally proposed the town would contain 6,000 units, housing a population of perhaps 25,000. It would be, in Washtenaw County, larger than any existing community, and consequently important both politically and socially. It is small wonder that the battle of Willow Run quickly got beyond the realm of technicalities of housing and town planning.

One reporter says bluntly, "I think the basic trouble at Willow Run is an underlying struggle to prevent the leadership of UAW-CIO (United Automobile Workers Union) from asserting itself. Putting the new plant outside of Wayne County looks like a grand maneuver to escape CIO. But at that the eastbound production line got so long that turntables had to be put in to divert it south at the county line. If labor follows the plant to Washtenaw County instead of continuing to live and vote in Wayne, the maneuver is lost."

Other comments run in the same direction, if not so openly. At any rate Ford did eject surveyors working for FPHA from his land, and has expressed his determination to fight it, his remark variously reported: "resist by every legal means," "to the last ditch," "to the last nickel."

And the UAW, at a recent convention in Chicago, passed a resolution denouncing Mr. Ford for his opposition to the Willow Run town idea and calling upon the President and the NHA for immediate action to revive the plan.

Meanwhile housing of Willow Run workers is important to the war effort. The war is not waiting for all of the implications of Bomber City to be aired and decided. For many months, nevertheless, Bomber City has held up virtually all other housing projects in the whole area. Only in the last few weeks has there been any sign of breaking this bottleneck to allow other housing to proceed.

Bomber City took its dominant place in the picture last April with the announcement of FPHA that it would build an ideal city. Of themselves, plans for the town were both ambitious and logical. It was to be a model for city planners of the future. Each home was to have grounds for a victory garden. Schools, churches, public buildings and recreation facilities were included in the plan. Around the city there was to be a green belt which would prevent springing up of shack communities such as are making unsightly the approaches to Detroit and other industrial cities.

Houses in Bomber City would be permanent and temporary at the same time. There would be no bathtubs until after the war. There would be shower stalls instead. The floors probably would be concrete instead of wood. There would be no basements. The houses were to cost an average of $3,750 each. There were to be 6,000 permanent dwellings, which would be so attractive that the workers would wish to keep them. Ten thousand temporary units were to be built between the city and bomber plant.

It was pointed out that for the sake of the safety of war workers no dwellings would be constructed within a mile of the bomber plant. Bomber City would be, in effect, a gift of a permanent community of 25,000 or 30,000 people to Washtenaw County, a community larger than Ann Arbor, largest city in the county.

The announcement evoked protests from several groups in Washtenaw County, including the board of supervisors, city councils and real estate boards, so a meeting was held at which representatives of the Federal Public Housing Administration explained the project. The descriptions of the city were received in silence. FPHA men reported to Washington that opposition was disappearing. Architects

Only a few private housing developments for Willow Run workers have been able to go forward. This one, by Fabricated Homes, Inc. and Edwin S. Smith, has recently been built in nearby Wayne

Now becoming rare in defense housing is brick veneer construction. This group of

and engineers went ahead with plans. It turned out later that the opposition merely had remained silent until it could collect sufficient facts to wage battle.

Chief of the fact collectors was Henry E. Riggs, a consulting engineer, former head of the civil engineering department at the University of Michigan and one of the organizers of the Huron-Clinton Metropolitan Authority which proposes to beautify the valleys of the Huron and Clinton rivers in Wayne and four adjacent counties. Professor Riggs supplied the amunition with which opponents of Bomber City bombarded the Truman Investigating Committee of the United States Senate and a special committee of the War Production Board.

Meanwhile, FPHA surveyors aroused the anger of farmers by entering their lands without asking permission, and FPHA real estate agents were accused of "brow beating" land owners into signing options. Opposition became active when it was learned that FPHA surveyors had been ejected from land in the area owned by Henry Ford, which is used for a farm trade school. Surveyors were driven off several farms. During May and June there was heated correspondence between Col. F. Charles Starr, FPHA representative in Detroit, and I. A. Capizzi, attorney for Ford. Col. Starr described the act of ejecting the surveyors as "unthinkable on the part of any American in wartime." Capizzi accused Col. Starr of failure to exercise common courtesy when he sent in surveyors without asking permission. Ford's threat to "resist by every legal method at his disposal not only the acquisition of his property but continuation of this project" still stands.

Most of the opposition to Bomber City has been based upon the permanence of the housing. In a letter to William K. Divers, regional representative of the National Housing Agency, Professor Riggs said:

"I am opposing this project because I cannot see where the building of 6,000 or more *permanent* houses in what is now purely a farming district is either necessary or justifiable, and because I am sure that this project cannot be completed and supplied with the necessary services to make it habitable before late in 1943.

"There must be very substantial provision made for *temporary* housing in the vicinity of the plant at the earliest possible moment, and the plans for such housing, as announced, have not been objected to . . . so far as I know."

Bomber City was planned on the information, or assumption, that the Willow Run plant would employ between 100,000 and 125,000 workers when it reached peak production. FPHA officials said they obtained this estimate from the Ford Motor Company. Ford officials denied that any estimate of the number to be employed was asked or given and stated that maximum employment would be 60,000. The FPHA assumed that 25,000 or 50,000 workers would be employed in the plant after the war. Capizzi denied that there were any plans to use the plant after the war. If used as an assembly plant, Willow Run would employ about 5,000 workers in peacetime.

Arguments in favor of building Bomber City included:

1. The Willow Run plant is a permanent manufacturing establishment. Even if the Ford Motor Company should fail to exercise its option to acquire the plant from the Defense Plant Corporation, it is to be expected that the government would find some other use for the large investment which is made in the plant and its service facilities.

2. The proposed city would offer "the finest living conditions" available to industrial workers within the reach of the plant and would share with Ypsilanti the advantage of being within easy commuting range. Therefore, it never would become a "ghost town."

3. Houses would be so dispersed that the danger of bombing would be minimized. It would be considerably safer than older, more closely built cities.

4. The decision to build Bomber City was made only after the situation had been studied and other possibilities discarded as being less well fitted to serve the program.

Opponents of the project advanced the following argument against building a permanent city:

1. The Willow Run plant will reach peak employment in December, 1942, long before the city could be built; therefore residents of Bomber City would be the last hired and the first laid off. With little prospect of employment in the area after the war, they would create a permanent welfare problem.

2. The site is 15 miles from the end of Detroit water mains. It is five miles from the Huron River. Great amounts of critical materials would be needed for water and sewage systems. The Huron River has been made clean at great expense, and under Michigan law a sewage disposal plant would be required. There are an ample number of vacant lots in Ypsilanti, Ann Arbor, the City of Wayne, Inkster and other nearby communities where public utilities are available already.

3. The size of the lots in the proposed city, 50 ft. by 100 ft., is not large enough to make it attractive as a permanent home for people who long for living space outside Detroit.

4. The distance from the Willow Run plant, an average of five or six miles, is too great to solve any transportation problem but not sufficient for safety from bombs aimed at the plant. Furthermore, workers concentrated on 50-ft. lots would be an attractive target for enemy bombers.

homes, built by Garling Construction Co., is in West Dearborn, west of Detroit

Detroit News

More representative of the type of housing proposed by private builders for the towns near Willow Run are these frame houses done in Evergreen Village by Frischkorn Construction Co.

They might better be scattered in near-by communities.

5. The city would be Federal-owned but State-governed. It could not be incorporated under Michigan law for at least three years because there must be at least 100 residents of three years standing to incorporate a city or village. Therefore, Bomber City would have to depend on township government, a very weak unit in Michigan.

After the arguments pro and con were made, opponents of the project appealed to the Truman Committee to investigate the project. They also asked the War Production Board to deny priorities for construction materials for a permanent new city. A special committee was appointed by the WPB to study the project.

With its estimate of the peak number of employees at the Willow Run plant reduced from 100,000 or 120,000 to 50,000 or 60,000, the Federal Public Housing Authority made a new proposal to build 2,500 instead of 6,000 permanent homes in Bomber City.

The opponents still objected. They wanted no permanent city whatever. The Ann Arbor Real Estate Board obtained pledges from 30 builders to complete construction of 2,500 houses in established communities before July 1, 1943, if they were granted priorities.

Whether Bomber City ever is to be built awaits the decision on priorities by the War Production Board. If these priorities are granted, the Federal Public Housing Authority still will face the threat of Henry Ford to block the plan "by every legal means."

A BREAK IN THE BOTTLENECK

FORTUNATELY there are signs that the bottleneck of Bomber City is being broken, and other housing projects, private and public, will be allowed to proceed.

The NHA program, which includes the private building under FHA as well as the public program under FPHA, has been revised according to changing facts and circumstances. The over-all NHA program originally called for a total of 43,000 units. When the estimates of Willow Run employees dropped from around 100,000 to 60,000 the NHA total program was cut to 13,000 units. As presented to the Truman Committee, these totaled 8,500 public housing units made up of 3,000 in dormitories, 1,000 temporary dormitory apartments, and 4,500 family dwelling units. The private housing program includes another 4,500 family dwelling units.

John B. Blandford, Jr., Administrator of NHA, has described the program thus:

"The revised program constitutes what we consider a minimum and it is possible that a greater quantity of housing may become necessary due to a revision upward in the estimate of peak employment or increasing difficulties in providing transportation. Any additional housing which may become necessary for the above mentioned reasons will in all probability be of a temporary nature.

"Of the 4,500 family dwelling units to be constructed with public funds, we propose to locate approximately 2,500 in the vicinity of the plant and 2,000 in the Wayne-Inkster area. The 2,500 to be located in the vicinity of the plant will be able to use, at least temporarily, the community facilities available at Ypsilanti and will probably be located as close to Ypsilanti as it is possible to find suitable sites. These 2,500 units, together with the dormitories for 3,000 workers and the 1,000 temporary dormitory apartments, will constitute the nucleus for any future temporary additions which may become necessary. By dividing the public housing between Ypsilanti and the Wayne-Inkster area the 2,000 units located in the latter area will also be able to use existing community facilities, at least temporarily. In this way it may become unnecessary for us to furnish all of the various facilities which would be necessary if a large new town site were developed at either location.

"The private housing programmed to serve the plant will be located principally in Wayne, Inkster, Ypsilanti and Ann Arbor on lots which have all or some of the utilities presently installed. It is estimated that such a plan will probably require all lots for which any substantial part of the utilities has been installed."

After the Truman Committee investigation the special Willow Run Committee of WPB recommended that the private building program be allowed to proceed, but that the Bomber City part of the public program be held for further study of the possibility of saving critical materials in the extension of utilities lines.

Raymond Foley, Michigan FHA director, has announced that the Willow Run district has been designated as a separate critical housing area. The new area includes Ann Arbor, Ypsilanti, Inkster and the City of Wayne. The designation was accompanied by unofficial assurance that utilities will be installed in at least part of the area. On that basis private builders are now preparing plans and priority applications indicating that the whole quota of 4,500 units will be accepted by them, with at least 50 per cent of the units for rent.

Bomber City itself has now been cut to 2,500 units and is the only major part of the housing program still to be decided.

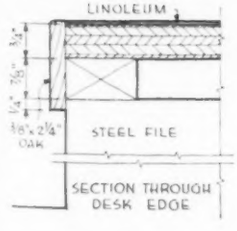
Detroit News

Herman Gardens, an FPHA project for 2,100 families, might have helped the housing shortage, but the Army may take it

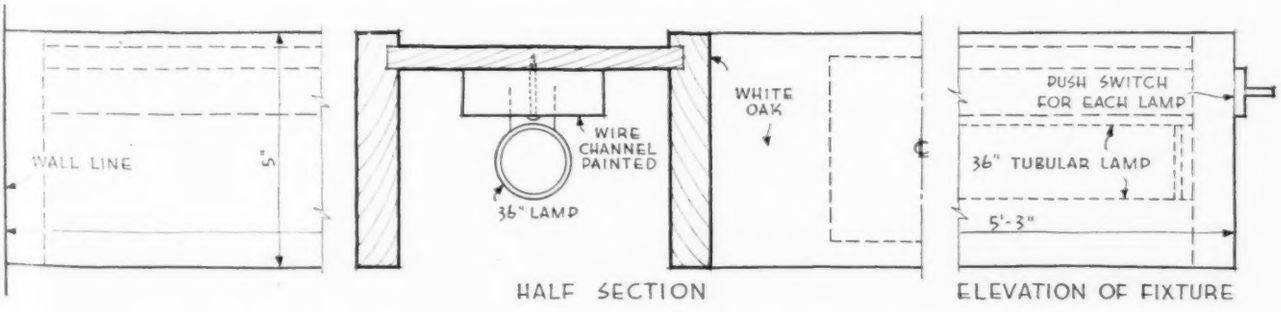
6 INTERIOR DETAILS

G. McStay Jackson, Designer; W. H. Buderus, Associate

Chicago Architectural Photographing Co.

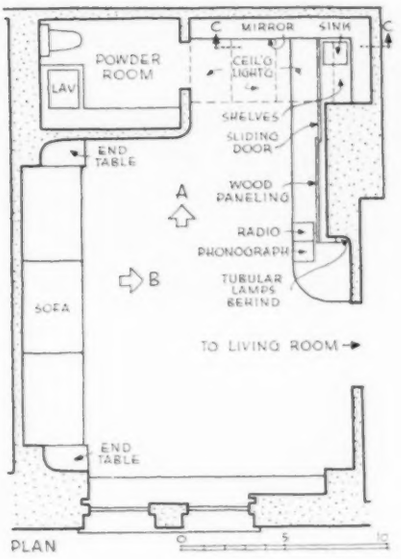


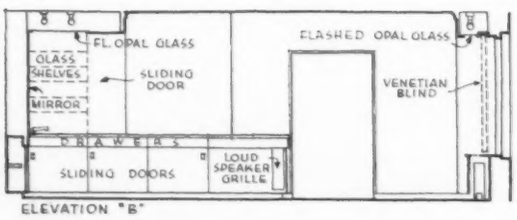
1. DUAL DESK. Actually a business office shared by two persons, this room contains ideas that might be readily incorporated into a house study. The desk is the feature of the design. Four low steel file cabinets, painted a strong yellow-green, support an oak-edged desk top that is surfaced in sand-colored leather. Centrally located along one wall of the room, the desk is lighted by a suspended, overhead fixture consisting of a wood frame in which two fluorescent lamps are mounted. The fixture is hung at a height that allows an unobstructed view of each person seated at the desk. The chairs, framed in oak, are upholstered in yellow-green leather.



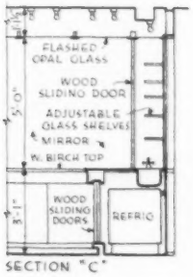
2. BAR. This bar and recreation room was originally a bedroom; in converting it, skillful use was made of an awkward corner to house the bar, the radio and a phonograph in a continuous built-in that terminates in a mirror wall. Lighting of the otherwise dark alcove area is handled with a flush-mounted soffit light, shielded with opal glass. A concealed tube illumines the area above the radio and phonograph units.

All woodwork is bleached curly maple in a very light finish; walls and rug are turquoise. The ceiling is painted sand color.





ELEVATION "B"



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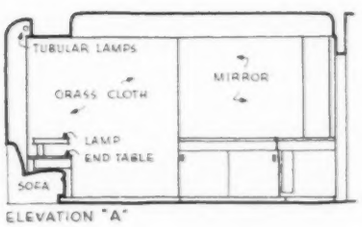

ELEVATION "A"

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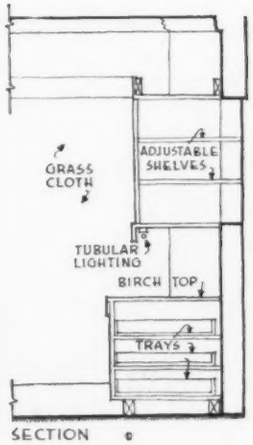

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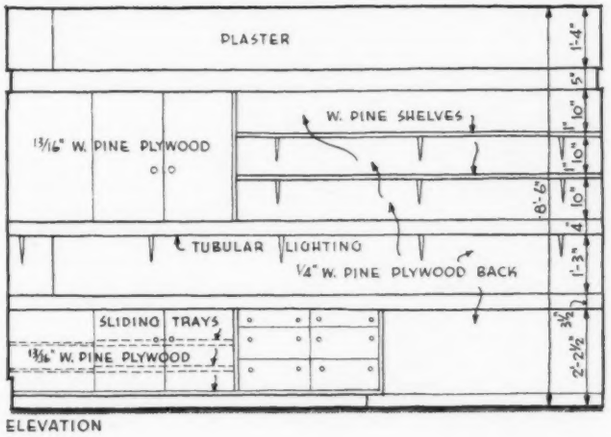
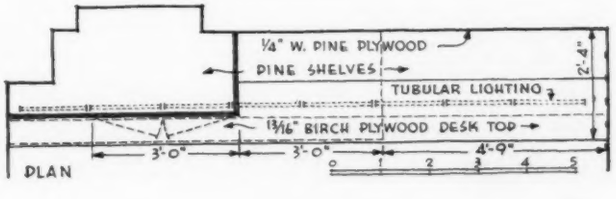


ELEVATION



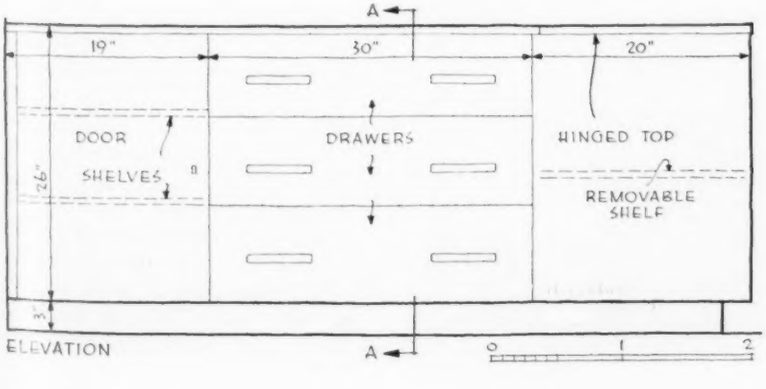
PLAN

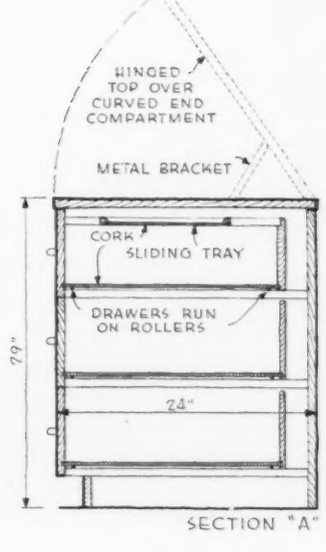
3. STUDY UNIT. This multi-purpose built-in is a successful solution on two counts: it corrects the proportions of a room that was too long for its width; it is an unusually well equipped study and storage unit. At the left (not visible in the photograph) is a cabinet for a phonograph, and a portion of the counter above is used for storing albums of recordings. A generous supply of cupboards and drawers provides storage space for desk equipment and for various items, logically assigned to living room use, which are desirably out of sight when not needed. The desk top is of white birch; all other woodwork is white pine. The whole work-top area is lighted by tube lighting installed beneath the shelves and cupboards above. Note the shelf for handy filing of unbound magazines. Walls of the room are surfaced with natural grasscloth; the carpet is a strong yellow-green, and the ceiling is sand color.

4. DINING UNIT. For cramped quarters such as are frequently encountered in the small city apartment, this fold-away table and built-in storage unit form an ingenious space-saving device. The oak sideboard unit, mounted on the wall, has cork-lined trays under the top ledge, and the drawers are used for silver and linen. Addition of a single leaf forms the dining table shown. All woodwork is natural striped oak; both walls and ceiling are in tones of sand; the carpet is soft brown, and furniture is upholstered in blue-green rough-textured material.

Chicago Architectural Photographing Co.

5. STORAGE. In this dual-purpose room, the low built-in separates the living and dining areas. On the living room side, wall space is gained for furniture placement; a bar and dining room storage drawers open toward the dining area. The unit at left contains cork-surfaced trays for glassware; the central drawers are for linen; at right is the liquor-storage compartment, with a lift-out tray, beneath which is additional storage space. The cabinet-work is of natural-finish oak; walls and ceiling are light sand-color and the carpet is light brown; upholstery is tomato and yellow-green.





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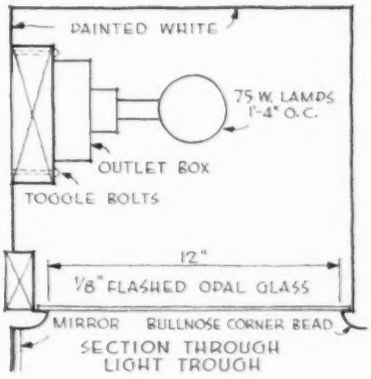
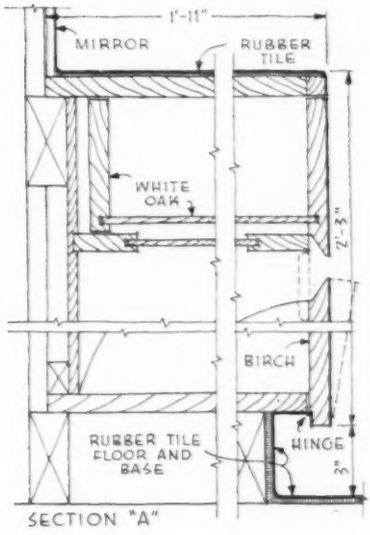
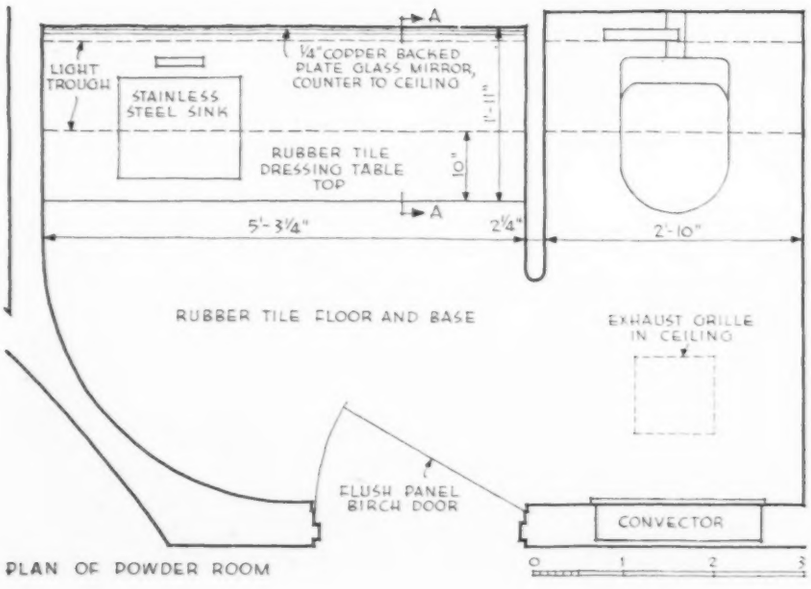






PLAN OF POWDER ROOM

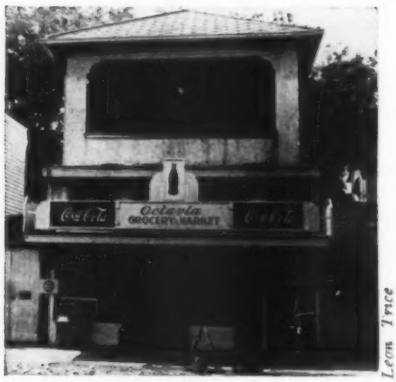
6. LAVATORY. This recessed lavatory unit is in a powder room; the casing is of stainless steel, with the horizontal surface finished in linoleum. At right is a drawer for towel storage, with a swing-down hamper beneath for used towels. A full wall mirror is brightly lighted by a flush fixture mounted at the top. The enameled walls are soft turquoise; the floor is turquoise rubber tile; the ceiling, white.

REMODELED FOR RENTAL

Moise H. Goldstein and Associates, Architects

WHILE this New Orleans remodeling job was completed before the $500 limit was placed on residential improvement, it is a type of project which the government encourages in war production areas, and it is a good illustration of the remodeling opportunity that even the most unpromising of structures may offer. The unsightly store building was in a Class A residential district, but a zoning ordinance permitted non-conforming commercial use for a period, if the building was not vacated; hence an adjoining property owner purchased it and had it converted. The "before" and "after" plans on the following page give the details of the project. The entire front of the building was redesigned and resurfaced, and the roof and projecting line at the second-floor level were retained. Objectionable, shanty-like garage structures at either side were eliminated, and entrance and private gardens substituted. Exterior styling was worked out to harmonize with the general architectural aspect of the neighborhood.

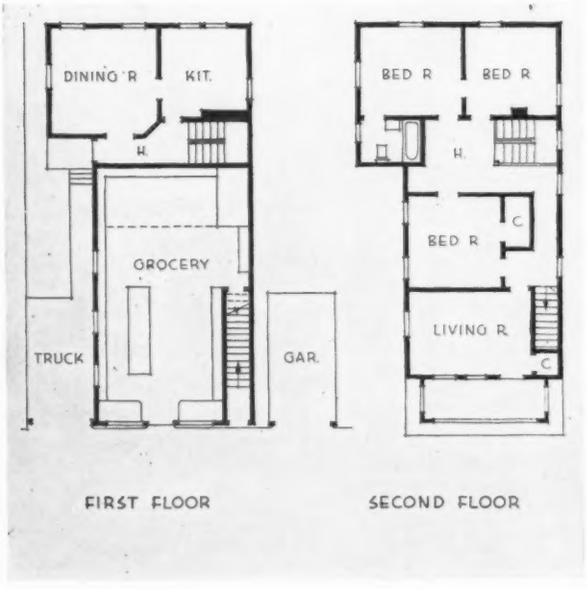
Leon Trice



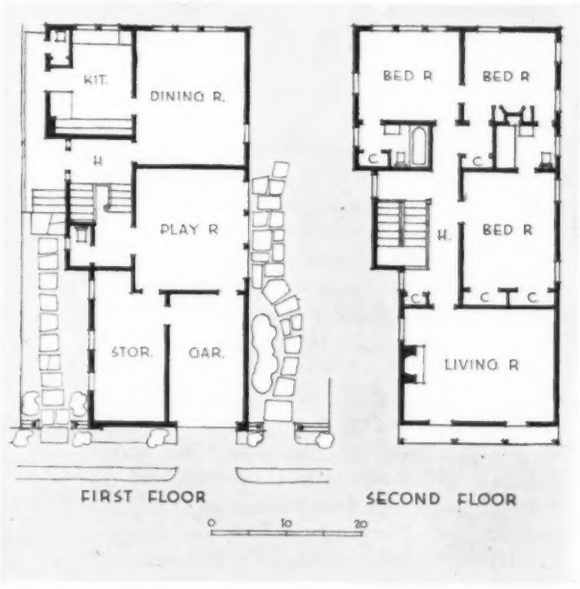
Leon Trice

REARRANGEMENT of certain elements produced a living room that is both wider and longer than the original; relocation of the stairway made room for the addition of a second bathroom. On the ground floor of the "after" plan, the area labeled "Storage" is used for storing caps, gowns and hoods that are worn in academic processions at Tulane University, near by. At Commencement times, the playroom and garage space are used for fitting and equipping the marchers. Total remodeling cost was $5,000.

BEFORE



AFTER



THE LIGHTING OF INDUSTRIAL PLANTS

THE accelerated tempo of war production calls for the revision of machines and methods in most existing plants, the building of new ones, and the adoption of the most advanced lighting methods in all plants.

Ten years ago it was fairly standard practice to allow one watt per square foot for lighting factory space. In terms of percentage cost—including wiring, fixtures and lamps—the usual allowance was approximately one-half of one per cent. This permitted an average lighting intensity of less than 10 foot-candles.

Today with new light sources and with growing demands for higher levels of lighting, estimates allowing 2¼ to 3 watts per square foot of factory space with fluorescent lamps and 6 to 8 watts per square foot with filament lamps are not out of line. This permits average lighting intensities of 50 foot-candles and better.

The following factors have made it possible to provide higher levels of light at lower and lower costs.

A. The efficiency of incandescent lamps has been increased and their prices have been progressively reduced.

B. New kinds of lighting fixtures made of new materials and designed to provide more light have been produced.

C. Electric current rates have gone steadily down.

D. New light sources—fluorescent lamps and rectified fluorescent lamps. (The latter will not be available due to savings in critical material.)

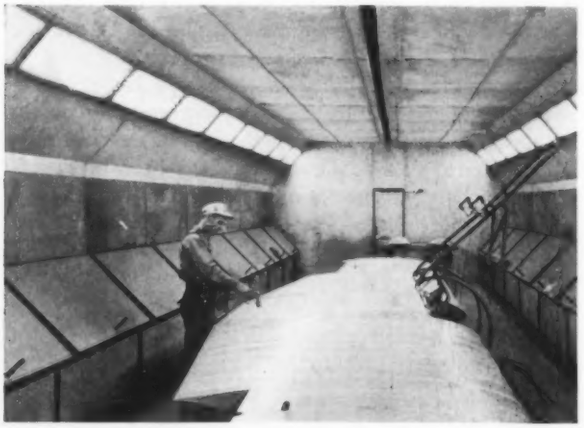
. . . BUILDING TYPES STUDY NO. 69

PREPARED FOR ARCHITECTURAL RECORD BY MAURICE GAUTHIER, ARCHITECT

LIGHT AS A PRODUCTION TOOL

Older or defective eyes are enabled to function more efficiently and with less fatigue when assisted by good illumination properly located with respect to the work

The maximum utilization of floor space is accomplished by well distributed lighting. The system employs 2-lamp fluorescent units on 10 ft. by 10 ft. spacing, 12 ft. and 13 ft. high



Diffused lighting reduces reflected glare in this spray tunnel for plane wings. Lighting consists of parallel rows of diffusing panels equipped with fluorescent lamps

As far back as 1923 tests showed that an increase in illumination of 2.6 foot-candles resulted in 18.5 per cent increased production.*

1. FEWER REJECTS

Better visibility of the object being worked upon means greater accuracy. With proper lighting no harsh, dark shadows exist which might confuse the object with its shadow or obscure detail in the shadowed area.

2. REDUCTION OF FATIGUE

The act of seeing involves thousands of small eye muscles as well as nervous and physical energy. The greater the effort of the eye to see, the greater the drain on the body's physical energy. Physical fatigue slows down the rate of production and affects its quality. Good lighting reduces strain.

3. REDUCTION OF ACCIDENTS

It is estimated by the National Safety Council, Inc. that 15 per cent to 25 per cent of all industrial accidents are due to poor lighting. In most cases where accidents are attributed to poor illumination they occur because there is improper quality of illumination or totally inadequate illumination. Many factors associated with poor illumination such as glare, light reflected from the work, and dark shadows hamper seeing and cause after-images and excessive visual fatigue which are important contributing causes of industrial accidents. Many accidents are also caused by delayed eye adaptation when coming from bright surroundings into dark interiors. Frequently accidents which are attributed to the individual's carelessness can actually be traced to difficulty of seeing, due to bad lighting.

4. MAXIMUM UTILIZATION OF FLOOR SPACE

Manufacturers have found that more work can be achieved with less floor space when proper artificial lighting is employed. It facilitates the arrangement of machines and eliminates crowding and dependence upon natural outdoor light. Particularly in factories does effective artificial light free us from the limitations of construction involved in the utilization of daylight. The width and length of structures with good artificial light are practically unlimited. It permits erection of windowless factories,

* Tests reported by James E. Ives, physicist, United States Public Health Service. (Reprint No. 973 from Public Health Reports, November 14, 1924.)

uninterrupted production in blackouts, ease of camouflage.

5. TWENTY-FOUR HOUR PRODUCTION

With working shifts boosted from 8 to 9 and 10 hours night and day it is absolutely necessary to provide the workers with the kind of working conditions that build their morale and heighten their efficiency. Proper lighting will help overcome the natural handicaps and reluctance of employees in working nights.

6. COMPENSATING POOR VISION

War has increased the proportion of employees over 50 years of age and those of all ages with deficient vision. Such eyes require more and better light for the visual task than do normal young eyes. It is therefore important that lighting levels be established which are sufficiently high not only to provide good seeing for normal eyes but also to meet the requirements for more light for the older and visually deficient employees.

7. EFFECTIVENESS OF SUPERVISION AND MINIMIZING OF ESPIONAGE OR SABOTAGE

Foremen can see their machines and men more readily.

8. PLANT CLEANLINESS

Poor illumination makes it difficult to see into corners or under machinery. These dark areas inevitably collect dirt and waste which would otherwise be cleaned out. In the well-lighted plant such dingy areas do not exist and much more sanitary conditions prevail.

AMOUNT OF LIGHT AND CHOICE OF LIGHT SOURCES

THE designing of industrial lighting installations is a matter of engineering calling for careful and experienced study of the specific problems and for their solution with a knowledge of the latest advances in the development of light sources and lighting equipment. The determination of the amount of light and the choice of light sources are governed by several factors. These factors very definitely establish the order of magnitude of illumination necessary for more efficient seeing in industrial operation.

Under good illumination it is possible to see an object much smaller in size and finer in detail than is discernible under poor illumination. Thus a determining factor in the amount of light to be provided is the *size or detail* of the object.

A relation exists between the *contrast* of an object or detail with its background and the amount of light required for easy seeing. Where a variety of materials is handled, the best contrast is achieved through the use of a background color that is the average color of the materials. Even when work is all one color contrast should not be too great.

Excessive contrast between object and background tends to strain the eye by producing after-images and blurred edges. The ideal condition is that in which the background is slightly lower in brightness than the object.

While more light is generally desirable in most working environments, sometimes the mere painting of a machine from black to gray, or the arrangement of a small, properly colored field back of the working area will do the job.

Another factor which determines the amount of light and the choice of light sources is the *brightness of the object.* The brightness of an object, with a surface that diffuses light falling upon it, is measured by the reflectivity of the object and the amount of light falling upon it.

The brightness of an object, with a shiny surface which produces specular reflections, is determined by the brightness of the light source in the direction in which the images of the light source are more or less perfectly reflected by the object.

Etched or sandblasted metals exhibit spread reflections while polished metals exhibit perfect specular reflections.

As it is not always possible to control the brightness of the work or to reduce its reflection factor, comfortable lighting may be provided by: 1. Increasing the size and correspondingly decreasing the brightness of the light source. 2. Increasing the general level of illumination without, however, increasing the brightness of each unit of the lighting equipment itself. This is done by increasing the number of units. This has a tendency to reduce the specular reflection from polished or spread surfaces because such reflections are not much brighter than the general brightness levels of the general surroundings.

Still another factor is the *speed of seeing.* The time required for seeing becomes less as the amount of light is increased. An increase in illumination from 1 foot-candle to a moderate level of 20 foot-candles increases the speed of seeing approximately 3 times. This enormous improvement in perception and recognition of surroundings affects practically everything the worker does.

It reduces the *time required for seeing* and some of this time, at least, becomes available for production. Another determining factor is the *duration of the visual task.* Prolonged work and sustained effort tire the eyes more than intermittent work. For continuous and prolonged visual tasks, levels of light in excess of those required for merely good seeing are necessary to prevent undue eye strain or fatigue.

QUALITY OF LIGHTING—COLOR

General lighting in order to be of acceptable quality must be: 1. Free from objectionable glare. 2. Free from excessive contrasts of brightness within visual field. 3. Distributed in a suitable manner. Diffused lighting is generally desirable.

So far as color quality is concerned, the approximately white light furnished by any of the commonly used light sources is suitable for most work since there seems to be no important difference in the speed, accuracy and ease of seeing under the light from these various sources.

Where fairly close color discrimination is a factor, light approaching the color of daylight is best. Incandescent and fluorescent bulbs are available for such purpose.

COLOR OF REFLECTING SURFACES — WALLS, FLOORS, CEILINGS

White floor acts as huge reflector and permits work to be performed under wings of planes without having to resort to auxiliary lighting on the assembly line of this great aircraft plant

A BALANCE is needed between light and color of reflecting surfaces. The most desirable is the condition in which the working area is slightly brighter than the surrounding areas. While the functional use of color concerns brightness more than hue, the matter of color choice —red, green, blue—offers an opportunity to control and influence human moods. People like color. Yet in industry it is necessary to use it with some discretion. Color may be just as distracting as it is pleasing. The color of walls, machines, backgrounds should obviously never be too pure or saturated. Light tones, pale in hue, are always best. However, brightness is the chief thing to be watched. There must not only be enough illumination to see clearly, but the object seen must be visible in its surroundings. It must have moderate rather than intense color contrast.

Walls brighter than the details of the task cause eye strain. They lower manual skill and prevent mental concentration. The room, on the outer boundaries of vision, should be fairly light in color, but slightly lower in intensity than the working areas. This will limit the eye to a comfortable light adaptation and prevent annoying pupillary changes. The eye accommodates itself more quickly and easily to brightness than darkness. In looking from a dark machine to a light wall, the wall has the advantage. But when the contrast is reversed (the wall toned down and the machine brightened) the eye can readily get down to work.

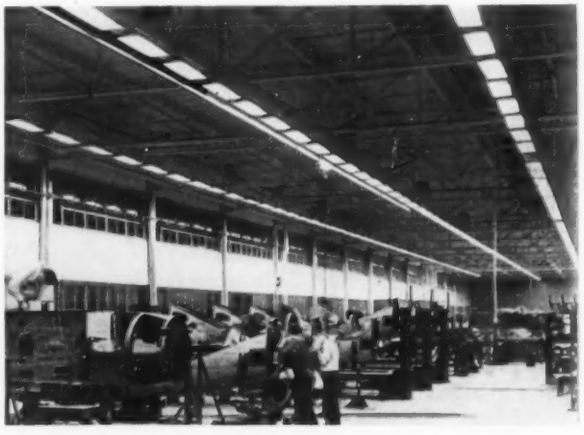
In certain kinds of manufacturing, such as airplane plants, white floors have been found to increase the general illumination 20.6 per cent by their action as giant reflectors. The reflection from the floor lights up the underside of wings, speeds up work and reduces mistakes.

Tests have been conducted in one of the largest airplane plants in the nation. These tests show that before production started, with a clean floor and reflectors, the average reflection factor of the white concrete floor in the main assembly was 44 per cent as compared with 27.4 per cent for the regular grey concrete floors in receiving areas. Sixty-one per cent more light was reflected by the white floors than by the grey.

At the end of the lamps' useful life and with floors as soiled as they could be under normal use, tests show a loss of 18 per cent in foot-candles over the white floors and a loss of 22 per cent over the grey floors. Thus the reflecting factor of the white floor was still more than 61 per cent higher than that of the grey.

These tests and studies further showed that without white concrete floors, proper lighting would have required 20 per cent more fluorescent fixtures, plus more and heavier copper in the distribution system, larger transformers and switchgear equipment, more steel and aluminum for reflectors, magnesium for cutouts, lead for cables, more zinc, rubber, and resins in insulation, more electric current.

When all added up it was found that the white concrete floor at 5c per sq. ft. extra cost paid for itself in seven months and will hereafter yield a return of about 90 per cent annually on the investment.



Fluorescent lamps in rows of individual fixtures give uniform lighting for the manufacture of fighter planes, with high intensity light and a minimum of shadows at the level of the work

LIGHT SOURCES

THREE types of light sources are in current use for the general lighting of industrial plants—incandescent filament, fluorescent, and mercury. Each has certain advantages that make it suitable for certain applications in lighting for war production.

1. INCANDESCENT FILAMENT LAMPS

Being practically point light sources of highly concentrated brightness, incandescent filament lamps lend themselves well to the control of their light by means of suitable reflectors and lenses, which have been made available in great quantities and varieties. Simplicity is one of the advantages of incandescent filament lighting. It requires no auxiliary equipment for the operation of the lamps. Incandescent lamps are compact and their initial cost is relatively small. Those of the higher wattages furnish great quantities of light which can be distributed effectively. Lamps are available in 15 to 1500 watt sizes and with inside frosted, clear or white bowl bulbs.

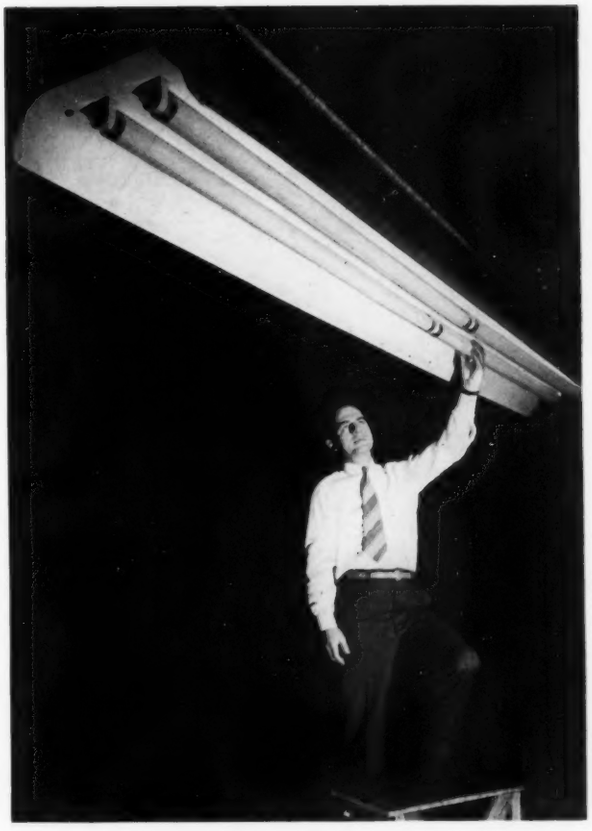
Incandescent filament lamps will operate in any position. The light output maintenance, especially with higher wattage lamps, is best when used vertically with the base up.

The clear bulb is best when used in adequately shielded reflectors such as high-bay units and diffusing equipment which protect the eyes from glare.

White bowl lamps are used in open type fixtures such as dome reflectors. They improve the quality of illumination by reducing direct glare, reflected glare and deep shadows. They operate base up only.

Silvered bowl lamps are standard lamps with a coating of "mirror" silver on the bowl. They range from 60 to 500 watts and provide soft indirect lighting.

While many modern installations use fluorescent lamps in continuous rows, with this type of lamp it is possible to achieve good even lighting with fewer fixtures placed at fairly low height



Because of the shortages of critical materials manufacturers have developed non-metallic fluorescent reflectors, providing efficient illumination with a minimum of priorities trouble

2. FLUORESCENT LAMPS

The fluorescent lamp is an "electric discharge lamp." The light from this lamp is given off by a coating of fluorescent powders on the inside of the glass tube. These substances are activated by ultra-violet radiations produced by the passage of an electric current through the mercury vapor enclosed in the tube. With these lamps, more light is made available for the current consumed than with incandescent lamps. They furnish light of white or daylight color at high efficiency, and are made to furnish a variety of other colors for special uses. The lamp gives off much less radiant heat for the amount of illumination than incandescent filament lamps.

Fluorescent lamps do not lend themselves to the direction and control of their light in the same ways as filament lamps, although special methods and equipment have now been developed for the effective control and distribution of the light of these lamps. Because of their tubular form and low surface brightness they lend themselves naturally to the form of large area, low brightness units and to their use in continuous rows or as individual units which furnish a quality of illumination highly desirable in industrial lighting. They are adaptable to low mounting or high bay installations up to 40 feet.

The continuous row system running crosswise of the normal direction minimizes installation and wiring costs

In this continuous row installation, one 40-watt fluorescent lamp in each troffer section provides an illumination of 50 foot-candles for this combined drafting room and office of a defense plant

To deliver 75 foot-candles at the bench level of this pattern department of a large Eastern concern, fluorescent fixtures were placed just 7 ft. above the floor, on 6 ft. by 9 ft. spacings

because the channel for each row is installed and wired as a unit. Although closed end reflectors* are preferable in continuous row mounting (the closed ends acting as baffles in breaking up the brightness effect of a long row of lamps) many successful continuous row installations, using the open-end reflector, have been made.

For satisfactory starting and operation, fluorescent lamps, like other electric discharge lamps, require standard auxiliary equipment: ballast, starters, lamp holders, and starter sockets.

Proper performance of this auxiliary equipment depends upon voltage being within a certain acceptable range. This range is clearly indicated on the ballast name plate. Decreased light output and uncertain starting and operation may result at excessive undervoltages and danger of overheating the ballast may accompany excessive overvoltage operation. In either case, the lamp life is likely to be shortened. Although satisfactory performance and operation of fluorescent lamps can be expected through a range of line voltages (such as 110-125 volts for normal-voltage ballast), care must be taken to operate within the recommended range.

* Due to the restrictions in the use of critical materials, the installation of closed-end reflectors is not permitted.

The ballast delivers the proper voltage and lamp current, one value for starting, another for normal operation. The ballast limits current to the value normally required by the lamp. The automatic starter switch must close and open with reliable timing and pass enough current through the filament electrodes for the time needed to preheat these sufficiently for quick and positive starting.

Although fluorescent lamps are designed for alternating current operation they may be used on direct current circuits if an approved direct current auxiliary or inductance unit and a series resistance of the correct value are employed. Direct current operation usually results in decreased useful lamp life and inferior lumen maintenance and starting liability. On the other hand, color quality and total light output of the lamp compare favorably with alternating current operation, and the stroboscopic effect is of course completely eliminated.

Stroboscopic Effect

High frequency stroboscopic effect (which is noticeable when observing a fast moving object, and which makes high speed rotating machinery appear to revolve slowly or stand still) results from normal variations of light output on alternating current.

Every lamp, when burned in the usual manner on alternating current, has a nonuniform light output caused by the cyclic variations in current. This effect is, of course, increased at lower frequencies. In electric discharge lamps where practically no energy is stored (as it is stored in the hot tungsten of a filament lamp), the light drops almost to zero along with the current between each half cycle. However, all the fluorescent powders but the one producing the blue color have a persistence of glow, or phosphorescence, which helps to reduce flicker in various colors of fluorescent lamps when operated from a 60-cycle circuit. Operation on two or more phases or with two-lamp ballasts brings the lamps out of phase, and the fluctuation in light output is further reduced and becomes comparable to the variation in low-wattage filament lamps.

3. MERCURY VAPOR LAMPS

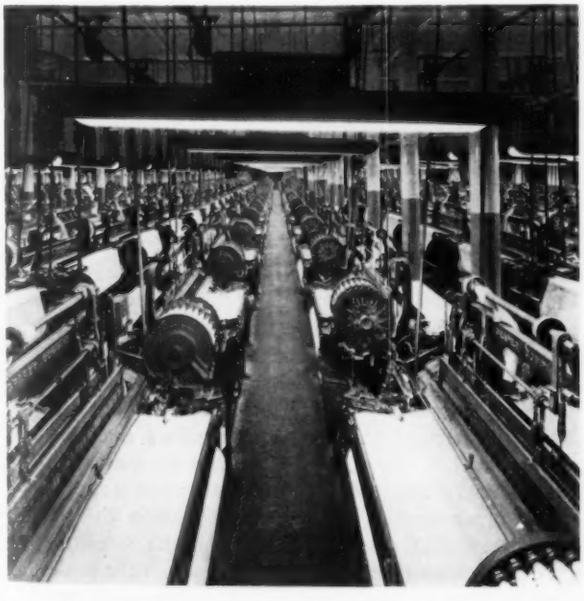
The high efficiency of mercury vapor lamps gives them a place of importance in industrial lighting, particularly with reference to high bay installations. There are two Mazda H (mercury) lamps receiving much consideration—the 400 watt H-1 lamp and the 3000 watt A-H9 lamp. Others available: AH-2, 250 watts, AH-4, 100 watts.

400 Watt H-1 Lamp

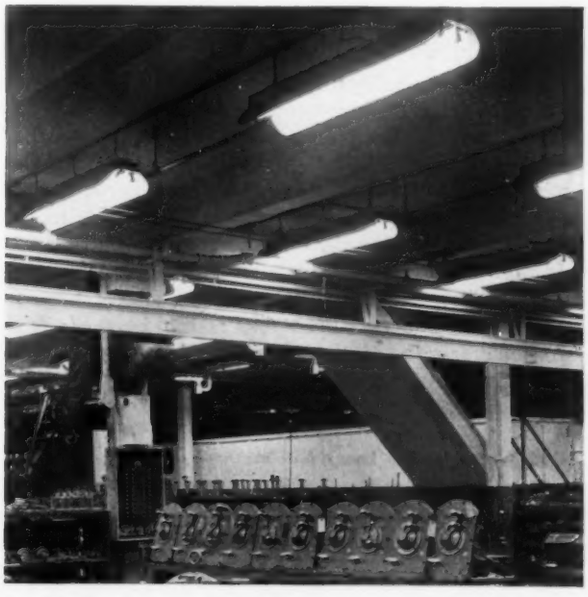
The 400 watt H-1 lamp is 13 inches long and a tubular bulb 2 inches in diameter. A standard mogul base is used and it is available for base up or base down burning, but in neither case can it be tilted more than 10 degrees from the vertical. Its light can be directed by reflector units like those used for incandescent filament lamps.

The 400 watt mercury lamp has a rated average life of 3000 hours and its initial output (after 100 hours) is 16,000 lumens or 40 lamp lumens per watt. At 70 per cent of its rated life, the rated output is 35 lumens per watt. Thus the lumen maintenance characteristics compare favorably with filament and fluorescent lamps. One of the advantages of this lamp is its high rated average life. Thus the normal replacement would be only one every 4-5 months when burned 24 hours a day, 7 days a week.

Under average conditions, the H-1 lamp requires about 7 minutes to reach full light output, and at full brilliance the arc is concentrated into a pencil-like stream of high intensity. A bluish argon glow is noticed for the first two minutes and the remaining time is required to complete the vaporization of the mercury. If the current is interrupted while the lamp is in operation, the lamp will not be relighted until it has cooled, after which



These single lamp fluorescent units are mounted 8 ft. above the floor, give 40 foot-candles of illumination. The box above the reflector contains the auxiliary equipment



Two-lamp 40-watt fluorescent units with open end porcelain enamel reflectors provide excellent lighting for this industrial interior. Minute detail is clearly visible on the various objects

3000-watt mercury lamps in porcelain enamel reflectors located on nominal 35 ft. by 40 ft. centers. The illumination in service is about 35 foot-candles. Fixtures may be lowered for cleaning or relamping

the arc will strike again automatically if the current is on. This characteristic precludes the use of this lamp for protective lighting service where the time element is all-important.

Because of the time required for relighting, and the blue-green color of mercury light, it is advisable to combine mercury lamps with incandescent lamps. This combination provides a more reliable lighting system, reduces stroboscopic effect, and provides appreciable color correction. The two light sources can be used in the same luminaire or in separate units so installed that their light mingles. This is known as mercury tungsten or mercury incandescent lighting.

3000 Watt Mercury Lamp A-H9

This lamp is of long tubular form which favors the reduction of shadows when units are properly spaced. It is 54⅞ in. long and 1¼ in. in diameter and the actual light source length or distance between electrodes is about 48 in. It has a rated life of 2000 hours and is used in high bay lighting because of its rating of approximately 120,000 lumens initially (after 100 hours).

The high lumen output of this lamp gives it a place of special importance in high bay (minimum 40 ft.) industrial installations, such as steel plants, dry docks, foundries, heavy duty erection shops, wherever high-level illumination is desired at high mounting heights with a minimum of fixtures.

Comparisons of the over-all cost of light (lamps, energy and owning charges) for various systems show that the 3000 watt A-H9 lamp produces light more inexpensively than any other light source now on the market. Maintenance costs (not included in comparison just mentioned) will be low because of the relatively small number of lamp replacements per year in a given area.

Both mercury lamps require auxiliary equipment for their proper operation. The H-1 lamp requires a regulating device in the form of a high-reactance transformer. This transformer may be located at any point in the circuit as long as no other current than that of the respective lamp is drawn from it and provided that the voltage drop between lamp and transformer does not exceed two volts. However, in most cases the auxiliary is located directly above the reflector on the supporting stem or else it is

An area of 22,000 sq. ft. is lighted by 220-400 watt mercury lamps mounted at a height of 32 ft. They provide about 60 foot-candles of illumination for the critical visual task performed

mounted on beams somewhere near the lighting unit.

Autotransformers for the A-H9 lamp have been made available and include a built-in capacitor for power factor correction. The autotransformer and connection leads are carried into a wiring compartment for direct conduit connection of line and lamp.

MAINTENANCE OF ILLUMINATION

SYSTEMS which are adequate when first installed will soon deteriorate unless properly maintained.

A regular definite system of maintenance must be established so as to insure that all lamps and accessories are kept clean, in proper adjustment and in good repair.

It is recommended that an illumination check be made with a foot-candle meter periodically, say once every month, and when illumination has decreased to 75 per cent of its initial value, the lighting equipment should be cleaned. In addition to cleaning of the lighting units, the frequent painting and maintenance of the surroundings —side walls, ceiling, machinery, etc., will help keep the lighting efficiency near the original value.

Group replacement plan of relamping can be established to coincide with the cleaning period with a resultant saving in maintenance costs. Easy access to all lighting units should be provided.

While general lighting conforming to present day standards serves for most uses in industry, there are some tasks in which the seeing is of a highly critical nature.

Supplementary local lighting affords the most practicable means of furnishing the necessary high level of illumination. This lighting is furnished by lighting units suspended over the work stations attached to the machines or by projector lamps so mounted that their light is directed upon the work.

OTHER TYPES OF LAMPS FOR INDUSTRIAL USE

Combination mercury installation. Each unit uses one 250-watt high-intensity mercury lamp and three 100-watt incandescent lamps. It provides 20 foot-candles upon working surfaces

Mercury lamps in prismatic reflector units provide 55 foot-candles of illumination for this great bomber plant. The mounting height is 35 ft.; the spacing 8 ft. 3 in. and 15 ft.

1. DAYLIGHT FILAMENT LAMPS

Daylight filament lamps have a light blue bulb and produce a light comparable to daylight. They are available in 60 to 500 watt sizes.

Because the bulbs of these lamps absorb about ⅓ of the light emitted by the filament the next larger size of lamp is required to produce approximately same illumination level as a clear lamp of given size.

These lamps are used in supplementary lighting units and for special assembling and inspection processes where whiter light than that provided by standard lamps is desirable.

2. FLOODLIGHT LAMPS

Made with filament concentrated into a small space for use in floodlighting equipment designed to give a narrow beam of light which can be projected a long distance. Available in 250, 500, 1000 watt sizes. Where it is not necessary to have a closely controlled beam, it is usually more desirable to use general service lamps in equipment designed to accommodate them.

3. VIBRATION LAMPS

Available only in 50 watt size. They are designed to withstand high frequency vibration produced by high speed machinery.

4. ROUGH SERVICE LAMPS

These are made in 50 and 100 watt sizes for use where severe shocks and bumps occur.

5. WATER-COOLED MERCURY LAMP

(Midget sun.) This lamp is made of special quartz glass. Although no bigger than a cigarette, it is 1/5 as bright as the sun's surface. It is used in photo-enlarging, engraving and blueprinting plants.

6. PROJECTOR LAMP

This lamp combines a reflector, lens, and 150 watt or 300 watt filament in one sealed-in unit. It is used to supplement lighting installations where a high level of accurately controlled lighting is required over a restricted area from a small unit.

It comes in spotlight and floodlight types and is made of heat-resisting glass which permits outdoor use. Mounted 5 ft. above work area the 150 watt spotlight lamp produces about 400 foot-candles and the beam covers an area 20 in. in diameter.

7. NEON GLOW LAMP

Used for pilot lights and indicators. Its light is produced through agency of electrically excited rare gases.

It operates directly from commercial lighting circuits and has no filament. Therefore it produces very little heat, withstands shock and vibrations and voltage variations without affecting its life or light output. The orange-red color of the neon lamp causes it to stand out from other surrounding light sources.

8. DRYING LAMP

The drying lamp produces a wealth of effective infrared (heat) rays instead of light. The most powerful is the 1000 watt unit. There are also the 500 watt lamp and two types of 250 watt lamps. These lamps speed process drying and surface heating processes; facilitate straight-line continuous flow production, and are used to dry photo prints, synthetic enamels and lacquers, industrial finishes of many kinds.

LIGHTING OF INDUSTRIAL PLANTS
1--RECOMMENDED LEVELS OF ILLUMINATION

ARCHITECTURAL RECORD
TIME-SAVER STANDARDS
SEPTEMBER, 1942

	Foot-candles
Aircraft:	
Sub-Assembly	30
Final Assembly (high bay areas)	40
Machine Shop	50
Assembly:	
Rough	10
Medium	20
Medium Fine	50
Fine	100B*
Extra Fine	200A*
Chemical Works:	
Hand Furnaces, Boiling Tanks, Stationary Driers, Stationary and Gravity Crystallizers	5
Mechanical Furnaces, Generators and Stills, Mechanical Driers, Evaporators, Filtration, Mechanical Crystallizers, Bleaching	10
Tanks for Cooking, Extractors, Percolators, Nitrators, Electrolytic Cells	20
Cloth Products:	
Cutting, Inspecting, Sewing	
Light Goods	30
Medium Goods	100
Dark Goods	200A*
Pressing, Cloth Treating (Oil Cloth, etc.)	
Light Goods	20
Medium Goods	50
Dark Goods	100B*
Foundries:	
Changing Floor, Tumbling, Cleaning, Pouring and Shaking Out	10
Rough Molding and Core Making	10
Fine Molding and Core Making	20
Inspection:	
Rough	20
Medium	30
Medium Fine	50
Fine	100B*
Extra Fine	200A*
Locker Rooms	10
Machine Shops:	
Rough Bench and Machine Work	20
Medium Bench and Machine Work, Ordinary Automatic Machines, Rough Grinding, Medium Buffing and Polishing	30
Fine Bench and Machine Work, Fine Automatic Machines, Medium Grinding, Fine Buffing and Polishing	100B*
Extra Fine Bench and Machine Work, Grinding and Fine Work	200A*
Plating	10
Polishing and Burnishing	20
Receiving and Shipping	10
Sheet Metal Works:	
Miscellaneous Machines, Medium Bench Work, Punches, Presses, Shears, Stamps, Welders, Spinning, Medium Bench Work	20C*
Tin Plate and Similar Inspection	B* C*
Stairways, Corridors and Passageways	5
Steel and Iron Manufacturing:	
Billet, Blooming, Sheet Bar, Skelp and Slabbing Mills	10
Boiler Room, Power House, Foundry, Furnace Rooms	10
Hot Sheet and Hot Strip Mills	10
Cold Strip, Pipe, Rail, Rod, Tube, Universal Plate and Wire Drawing	10
Merchant and Sheared Plate Mills	20
Store and Stock Rooms:	
Rough Bulky Materials	5
Medium or Fine Material Requiring Care	10
Testing:	
Rough	20
Fine	30
Extra Fine Instruments, Scales, etc.	100A*
Textile Mills (Cotton):	
Opening, Mixing, Picking, Carding, and Drawing	10
Slubbing, Roving, Spinning, Spooling	20
Grading	100B*
Warping on Comb	30
Beaming and Slashing on Comb:	
Grey Goods	20
Denims	100B*
Textile Mills (Cotton) continued	
Inspection:	
Grey Goods (Hand Turning)	50
Denims (Rapidly Moving)	200A*
Automatic Tying-in, Weaving	50B*
Drawing-in by Hand	100A*
Woolen:	
Carding, Picking, Washing, Combing, Twisting, Dyeing	15
Drawing-in, Warping:	
Light Goods	20
Medium Goods	50
Dark Goods	100A*
Weaving:	
Light Goods	20
Medium Goods	50
Dark Goods	100B*
Knitting Machines	20
Toilets and Wash Rooms	10
Warehouse	5
Welding	30
Woodworking:	
Rough Sawing and Bench Work	15
Sizing, Planing, Rough Sanding, Medium Machine and Bench Work, Gluing, Veneering, Cooperage	20
Fine Bench and Machine Work, Fine Sanding, Finishing	50

OFFICES AND DRAFTING ROOMS

	Foot-candles
Offices:	
Bookkeeping, Typing and Accounting	50
Business Machines—Power Driven (Transcribing and Tabulating)—Calculators, Key Punch, Bookkeeping	100A*
Conference Room:	
General Meetings	30
Office Activities (See Desk Work)	
Corridor and Stairways	5
Desk Work:	
Intermittent Reading and Writing	30
Prolonged Close Work, Computing, Studying, Designing, Reading Blueprints and Plans	50
Drafting:	
Prolonged Close Work—Art, Drafting and Designing in Detail	50
Filing and Index References	30
Lobby	20
Mail Sorting	30
Reception Rooms	20
Stenographic Work:	
Prolonged Reading Shorthand Notes	50
Vault	20

*** The foot-candle values in this table are, in general, those given in the Recommended Levels of Illumination sponsored by the Better Light-Better Sight Bureau. The lighting levels for the aircraft industry were supplied by the engineering department of a typical large plane factory. The footnotes A*, B*, and C*, describing methods of obtaining the recommended lighting levels for the more difficult seeing tasks, are based on the notes published in connection with Table I. Minimum Foot-candles in Service, in the American Recommended Practice of Industrial Lighting, 1942. In that manual, sponsored by the Illuminating Engineering Society and approved by the American Standards Association, minimum foot-candle levels of illumination are given for a comprehensive list of industries.**

A*—100 foot-candles of illumination or more required. To be furnished by at least 20 foot-candles of general illumination plus specialized supplementary lighting to the required level. Installation must not only provide a sufficient amount of light, but also provide the proper direction of light, diffusion, eye protection and, insofar as possible, must eliminate direct and reflected glare as well as objectionable shadows. This lighting is recommended for seeing tasks involving (a) the discrimination of extremely fine detail under conditions of (b) extremely poor contrast (c) for long periods of time.

B*—50 to 100 foot-candles of illumination required. For the quality of the lighting and usual manner of providing it see A* above. Localized general lighting may sometimes be employed, lighting units over the work stations furnishing the required illumination on the work and, as well, sufficient general illumination in the intervening areas. This lighting is recommended for seeing tasks involving (a) the discrimination of fine detail under conditions of (b) a fair degree of contrast (c) for long periods of time.

C*—The essential requirements are that the luminous area shall be large enough to cover the surface which is being inspected and (2) that the brightness be within the limits necessary to obtain comfortable contrast conditions. This involves the use of light sources of large area and relatively low brightness in which the source brightness is the principal factor, rather than the foot-candles produced at a given point.

The seeing tasks of this group require the discrimination of fine detail by utilizing (a) the reflected image of a luminous area or (b) the transmitted light from a luminous area.

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SEPTEMBER, 1942

LIGHTING OF INDUSTRIAL PLANTS
2—FIXTURES FOR FILAMENT AND MERCURY LAMPS

The tables and much of the data incorporated in these Time-Saver Standards, on this and the following pages, are adapted from those issued by the General Electric Company, and are used with permission.

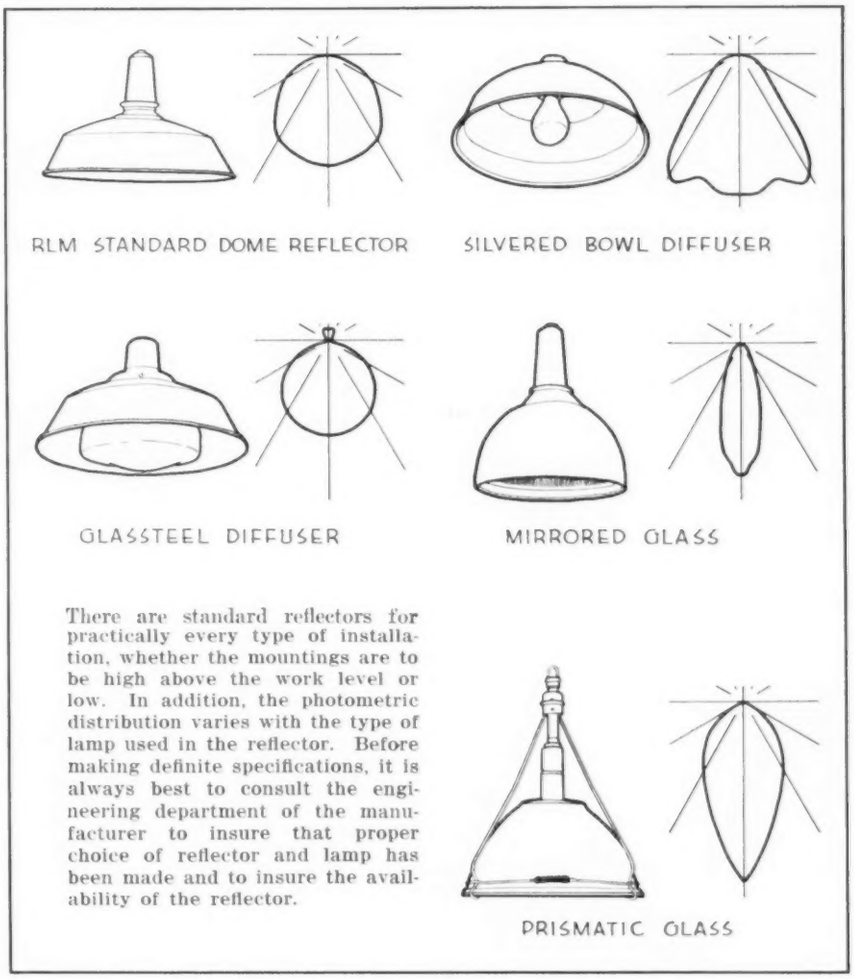
CHOICE OF REFLECTORS

Although filament lamps and mercury lamps type H operate on entirely different principles, the general types of fixtures available may be used with either type of lamp.

Several fundamentals of performance are considered by engineers and architects in the choice of types of units.

1. Desirable distribution of light and suitability for the particular interior involved.
2. Efficiency of light output.
3. Inherent maintenance of initial efficiency and ease of periodic cleaning and lamp replacement.
4. Adaptability to use of larger lamp should more light be required.
5. Sturdiness of construction.
6. Cost of installation, operation and maintenance.

The relative importance of each of these factors varies with different applications. The elimination of bad shadows in certain rooms might be of first importance, whereas in others the efficiency of producing illumination on the floor and ease of maintenance would rank ahead. In choosing between two or more units, the industrial architect should be governed by such considerations rather than by first cost alone.



There are standard reflectors for practically every type of installation, whether the mountings are to be high above the work level or low. In addition, the photometric distribution varies with the type of lamp used in the reflector. Before making definite specifications, it is always best to consult the engineering department of the manufacturer to insure that proper choice of reflector and lamp has been made and to insure the availability of the reflector.

RLM Standard Dome Reflector

This standard porcelain-enameled steel reflector meets many of the general lighting requirements of industry. It is the standardized product of a large number of manufacturers and must meet rigid specifications which insure its mechanical excellence and lighting efficiency. For general lighting purposes the recommendation is to use white bowl lamps with these reflectors. Practical for the use of inside frosted lamps or mercury H lamps in locations where mounting height is above 20 feet. A glass cover plate should be employed to keep the reflecting surface clean when used in dusty or smoky locations.

Silvered Bowl Diffuser (for use with silvered bowl filament lamps)—

Because this type of fixture is equipped with semi-diffusing aluminum insert, its use has been discontinued and prohibited.

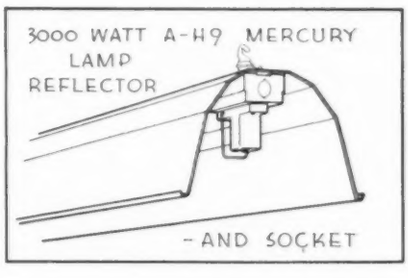
Glassteel Diffuser

This porcelain-enameled steel reflector is fitted with an opal glass diffusing globe which completely encloses the lamp. Thus, a much softer, more diffused light is obtained. Either clear, inside-frosted or mercury lamps may be used. Color correcting globes are also available where a whiter light is desired. An installation of glassteel diffusers provides a high quality of illumination without excessive brightness, harsh shadows, direct or reflected glare.

High-Bay Reflectors

These luminaires provide a relatively concentrated distribution of light and are generally used for lighting high-bay areas. They come in prismatic glass, mirrored glass and aluminum.* The more highly concentrating types should be used in bays which are narrow in comparison to their height. With such units the sharper shadows, greater reflected glare and low illumination on vertical surfaces must be balanced against the increased efficiency of light directed to the working plane.

*Unobtainable because of priorities.



Porcelain-enameled reflector for the 3,000 watt A-H9 mercury lamp is available.

The unit measures 6¾ by 12¾ by 60 inches. Equipment for this lamp is expected to be announced by various manufacturers in the near future.

Porcelain socket for the A-H9 lamp is equipped with a wire loop which helps prevent the lamp from falling during handling of the fixture.

LIGHTING OF INDUSTRIAL PLANTS
3—LUMINAIRES FOR FLUORESCENT LAMPS

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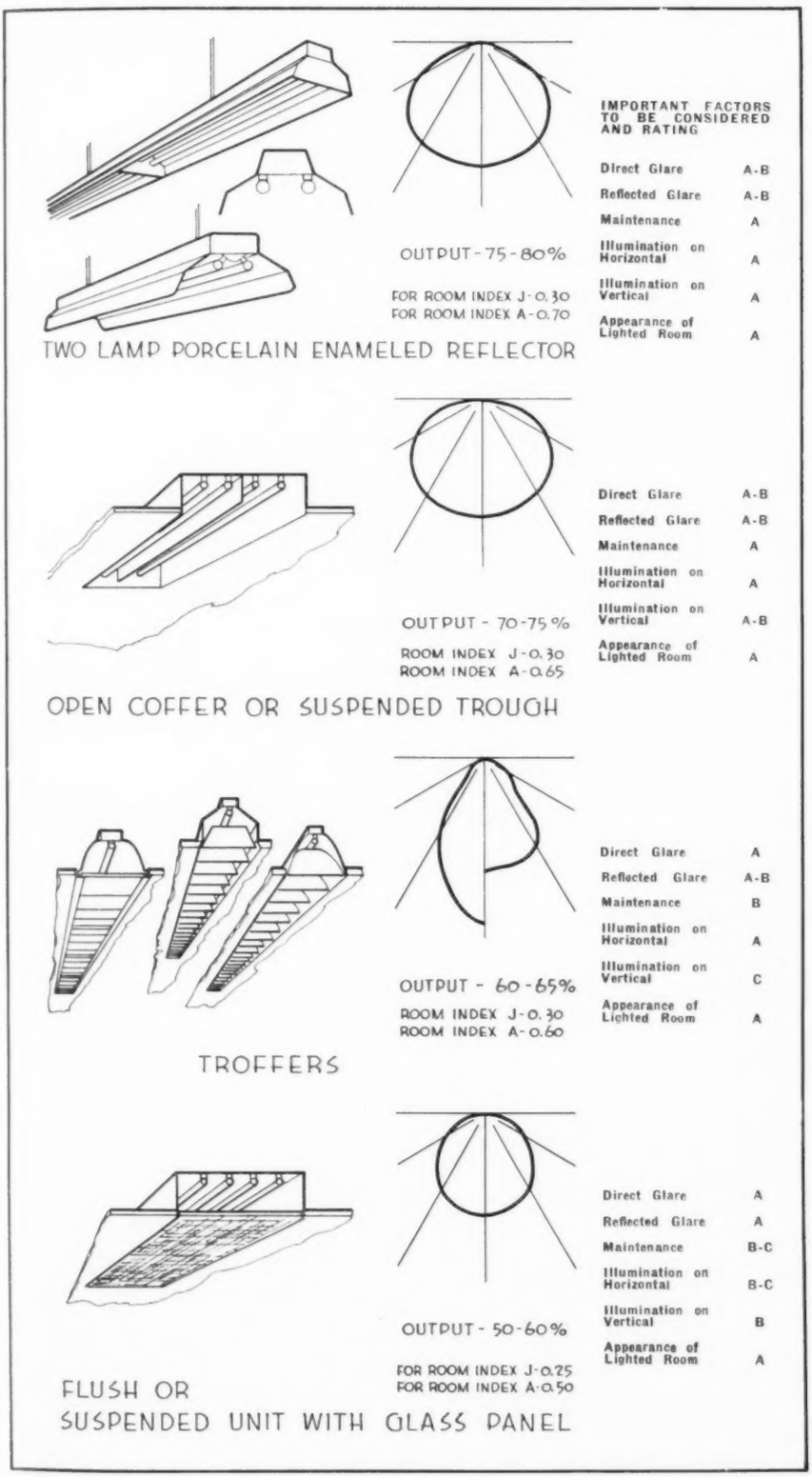

Two-lamp Porcelain Enameled Reflector

Sides of reflector shield lamps from direct view crosswise to angle of 15° or more below the horizontal. Closed ends provide some shielding in lengthwise direction.

Due to the restriction in the use of critical materials, no *closed end* reflectors are available.

New non-metal reflectors will shortly be available. These are made of hardboard with baked enameled surfaces. Applications—Industrial interiors, warehouses, stockrooms, etc.

Open Coffer or Suspended Trough

Crosswise shielding is dependent upon depth of coffer. If more than two rows of lamps are used, it is generally desirable to use a lengthwise baffle similar to that shown.

Applications—Certain types of factory offices, industrial interiors, warehouses.

Maintenance—Ease of maintenance because of closed top and absence of dust retaining surfaces.

Troffers

Spread or diffuse reflectors with louvers and specular reflector with lens plates.

Sides of louvered troffers provide shielding in crosswise direction (usually 45° below horizontal); louvers provide shielding in lengthwise direction (30° below horizontal) which is satisfactory for most critical seeing tasks. Louvers if opaque should have a surface with diffuse or spread reflection characteristics. Protection with lens plates depends upon several factors. In some cases it may be desirable to add a supplementary system to light the ceiling and reduce harsh contrasts of brightness.

Applications — Particular inspection problems and factory offices.

Maintenance—The vertical surfaces tend to collect little dust. May be easily cleaned and relamped if provision is made for removing louvers. For troffers with lens plates the discussion under next type applies.

Flush or Suspended Unit with Glass Panel

Brightness at higher angles (direct glare) is reduced considerably and with some glasses those at the lower angles (reflected glare) are also diminished appreciably. More diffusing glasses provide very good brightness control but reduce output.

Lamp centers should be a minimum of 2″ above glass and luminous sides, or a supplementary system directing

LIGHTING OF INDUSTRIAL PLANTS
4—DATA FOR LIGHTING DESIGN

LUMINAIRE SPACING*

Light Distribution	Diffused						Semi-Concentrating	Concentrating
Mounting Height of Luminaire (Ceiling Height for Indirect and Semi-Indirect Luminaires)	Indirect	Semi-Indirect	Semi-Direct		Direct		Direct	Direct
All Dimensions In Feet	Spacing Between Units	Spacing* From Walls	Length of Suspension	Usual Spacing Between Units	Maximum Spacing Between Units	Spacing* From Walls	Maximum Spacing Between Units	Maximum Spacing Between Units
8	9	3	1-3	7	7½	3	5½	2½
9	9½	3	1½-3	8	8	3	6	3
10	10½	3½	2-3	9	9	3½	7	4
11	12	3½		10	10½	3½	8	4½
12	14	4	2½-4	10-12	12	4	9	5
13	15	4		10-12	13	4	10	5½
14	17	5	3-4	10-13	15	5	11	6
15	19	5		10-13	17	5	12	6½
16	21	6		10-13	19	6	13	7
18	23	6	4-5	10-20	21	6	15½	8
20 or More	26	7	4-6	18-24	24	7	17½	9

ROOM INDEX**

For Semi-Indirect and Indirect Lighting	CEILING HEIGHT—FEET: 9 and 9½	10 to 11½	12 to 13½	14 to 16½	17 to 20	21 to 24	25 to 30	31 to 36	37 to 50
For Direct and Semi-Direct Lighting	MOUNTING HEIGHT ABOVE FLOOR—FEET: 7 and 7½	8 and 8½	9 and 9½	10 to 11½	12 to 13½	14 to 16½	17 to 20	21 to 24	25 to 30	31 to 36	37 to 50
Room Width (Feet)	Room Length (Feet)	ROOM INDEX									
9 (8½-9)	8-10	H	I	J	J						
	10-14	H	I	I	J						
	14-20	G	H	I	J	J					
	20-30	G	G	H	I	J	J				
	30-42	F	G	H	I	J	J	J			
	42-up	E	F	G	H	I	J	J			
10 (9½-10½)	10-14	G	H	I	J	J					
	14-20	G	H	I	J	J	J				
	20-30	F	G	H	I	J	J				
	30-42	F	G	G	H	I	J	J			
	42-60	E	F	G	H	I	J	J			
	60-up	E	F	F	H	H	I	J			
12 (11-13½)	10-14	G	H	I	I	J	J				
	14-20	F	G	H	I	J	J				
	20-30	F	G	G	H	I	J	J			
	30-42	E	F	G	H	I	J	J			
	42-60	E	F	F	G	H	I	J			
	60-up	E	E	F	G	H	I	J			
13-15½ 14	14-20	F	G	H	H	I	J	J			
	20-30	E	F	G	H	I	J	J			
	30-42	E	F	F	G	H	I	J	J		
	42-60	E	E	F	F	H	I	J	J	J	
	60-90	D	E	E	F	G	H	J	J	J	
	90-up	D	E	E	F	F	G	I	J	J	
17 (16-18½)	14-20	E	F	G	H	I	J	J			
	20-30	E	F	F	G	H	I	J			
	30-42	D	E	F	G	H	H	J	J	J	
	42-60	D	E	E	F	G	G	I	J	J	J
	60-110	D	E	E	F	G	G	I	J	J	J
	110-up	C	D	E	E	F	G	H	I	J	J
20 (19-21½)	20-30	D	E	F	G	H	I	J	J		
	30-42	D	E	E	F	G	H	I	J	J	
	42-60	D	D	E	E	F	G	I	J	J	J
	60-90	C	D	E	E	F	G	H	J	J	J
	90-140	C	D	D	E	F	F	H	I	I	J
	140-up	C	D	D	E	F	F	H	H	I	J
24 (22-26)	20-30	D	E	E	F	G	H	I	J	J	
	30-42	C	D	E	E	G	G	I	J	J	
	42-60	C	D	D	E	F	G	H	I	J	J
	60-90	C	D	D	E	F	F	H	I	J	J
	90-140	C	C	D	E	E	F	G	H	I	J
	140-up	C	C	D	E	E	F	G	H	I	J
30 (27-33)	30-42	C	D	D	E	F	G	H	I	J	J
	42-60	C	C	D	D	F	F	H	H	I	J
	60-90	B	C	C	D	E	F	G	H	I	J
	90-140	B	C	C	D	E	E	F	G	H	I
	140-180	B	C	C	D	E	E	F	G	H	I
	180-up	B	C	C	D	E	E	F	G	H	I
36 (34-39)	30-42	B	C	D	E	F	F	H	I	I	J
	42-60	B	C	C	D	E	F	G	H	I	J
	60-90	A	C	C	C	E	E	F	H	H	J
	90-140	A	B	C	C	D	E	F	G	H	I
	140-200	A	B	C	C	D	E	F	F	G	H
	200-up	A	B	C	C	D	E	F	F	G	H
42 (40-45)	42-60	A	B	C	C	E	F	G	H	I	I
	60-90	A	B	B	C	D	E	F	G	H	I
	90-140	A	B	B	C	D	D	E	F	G	H
	140-200	A	A	B	C	D	D	E	F	G	H
	200-up	A	A	B	C	D	D	E	F	F	G
50 (46-55)	42-60	A	A	B	C	D	E	F	G	H	I
	60-90	A	A	B	C	C	D	F	F	G	H
	90-140	A	A	A	C	C	D	E	F	F	G
	140-200	A	A	A	C	C	D	E	E	F	G
	200-up	A	A	A	C	C	D	E	E	F	G
60 (56-67)	60-90	A	A	A	B	C	D	E	F	G	H
	90-140	A	A	A	B	C	C	D	E	F	G
	140-200	A	A	A	B	C	C	D	E	E	F
	200-up	A	A	A	B	C	C	D	E	E	F
75 (68-90)	60-90	A	A	A	A	B	C	D	E	F	G
	90-140	A	A	A	A	B	B	C	D	E	F
	140-200	A	A	A	A	B	B	C	D	E	F
	200-up	A	A	A	A	B	B	C	D	E	F

some light to the ceiling and walls is desirable, so as to relieve possible harsh brightness contrasts.

Applications — For inspection problems requiring a uniform brightness source.

Maintenance—The horizontal surface of the glass is naturally dust collecting: the depreciation, however, depends upon tightness of joints. The glass bottom should be hinged or otherwise easily removable to permit easy cleaning and lamp replacement.

GENERAL CONSIDERATIONS

General lighting design is a procedure which allows us to predetermine the lumens per sq. ft. (foot-candles) delivered to a horizontal work plane corresponding to the floor area. Conversely, knowing the foot-candles desired (lumens per sq. ft.) the problem is to account for losses due to room proportions, color of walls and ceiling, and fixture efficiency and light distribution, so that we can specify the total lumens that must be generated by the lamps. The procedure is the same regardless of the type of lamp used. The accompanying tables take these factors into account.

Foot-candle Standards

The chart (Recommended Levels of Illumination) on page 73 indicates the general foot-candle levels being employed in practical installations.

Equipment Spacing and Layout

In order to get fairly uniform illumination over an area, the maximum spacing between units as shown in the table should not be exceeded. Closer spacing to conform to bays and other building construction features is quite often necessary. Downlight and similar concentrating reflectors require close spacing, depending on the degree of light concentration. The actual spacing for different types can best be worked out by the point-by-point method using the candle power distribution curve for the specific unit under consideration.

Where continuous rows of units such as fluorescent troffers are used, the figures apply to the spacing between rows. However with individual fluorescent equipment (where the

*Where desks and benches are next to wall. Otherwise one-half the spacing between units is satisfactory.

**Room Index is the classification of a room according to its proportions; large and small rooms of the same proportion have the same index. Hence, for large rooms of dimensions greater than those shown, divide each dimension by the same number and use the index determined for the smaller room.

LIGHTING OF INDUSTRIAL PLANTS
5—DATA FOR LIGHTING DESIGN

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lumen output is limited) conventional spacing distances cannot be used. The problem then becomes one of first figuring out the number of fixtures required to deliver the necessary lumens, and then planning the layout to accommodate this number of units.

Room Proportions

This table classifies rooms according to width, length and height of light source. For indirect and semi-indirect luminaires use the ceiling height. Determine the room index and apply it in the Coefficients of Utilization Table.

Coefficient of Utilization

This table brings together all of the factors that affect the utilization of light. The figure obtained by reference to this table (for the type of fixtures used, the size and finish of the room in which these are to be installed) is the percentage of the lumens given out by the lamps that reaches the working plane. For example, a utilization factor of 40 means that 40 per cent of the light is useful in producing foot-candles and that 60 per cent is absorbed by the walls, ceiling and fixture itself. Luminaire efficiency and light distribution—coefficients of utilization—are calculated for the output and distribution shown and the sketches of fixture types merely help identify units which may fall into each class. Several luminaires may look about the same but differ considerably in efficiency and light distribution.

Space does not permit publishing data on all the specific luminaires on the market, but if actual performance data on a specific luminaire are available, the range of data published is sufficient to the designer to make acceptable allowances for any departures.

Initial Foot-candles vs. Foot-candles Maintained in Service

Initial foot-candles measured when lamps are new and when the equipment is clean will be higher than the average maintained in service. To allow for this, a maintenance factor (M.F.) is given to indicate about the percentage of initial foot-candles to be expected under reasonable maintenance schedules of cleaning and repainting.

The lamp lumens required to light a room are computed from the formulas at the right.

COEFFICIENTS OF UTILIZATION

FILAMENT AND MERCURY LUMINAIRES

Candlepower Distribution	Ceiling	75%			50%			30%	
	Walls	50%	30%	10%	50%	30%	10%	30%	10%
	Room Index	COEFFICIENTS OF UTILIZATION							
	J	.40	.38	.36	.39	.38	.36	.38	.36
M.F. = .70	I	.48	.46	.46	.47	.46	.46	.45	.43
HIGH BAY UNIT	H	.51	.51	.50	.50	.50	.49	.50	.48
	G	.55	.54	.54	.54	.52	.52	.52	.51
	F	.58	.56	.55	.55	.55	.54	.55	.53
	E	.60	.59	.58	.59	.58	.57	.57	.56
	D	.64	.61	.60	.62	.60	.60	.60	.59
	C	.65	.63	.61	.63	.62	.60	.60	.60
	B	.65	.64	.63	.64	.62	.62	.62	.61
	A	.66	.65	.64	.64	.63	.62	.62	.62
	J	.37	.32	.28	.37	.32	.28	.31	.28
M.F. = .75	I	.46	.41	.38	.45	.40	.37	.40	.37
R.L.M. DOME REFLECTOR	H	.50	.46	.43	.49	.46	.43	.45	.43
	G	.54	.50	.47	.53	.50	.47	.48	.47
	F	.58	.54	.50	.56	.52	.50	.52	.50
	E	.62	.59	.56	.61	.58	.56	.57	.56
	D	.67	.64	.60	.65	.63	.60	.62	.60
	C	.69	.66	.63	.67	.64	.63	.64	.62
	B	.72	.69	.67	.70	.68	.66	.67	.65
	A	.74	.71	.69	.72	.69	.68	.68	.67
	J	.35	.30	.26	.34	.30	.26	.29	.26
M.F. = .75	I	.44	.39	.36	.43	.38	.35	.38	.35
SILVERED BOWL LAMP TROUGH AND COFFER	H	.48	.44	.41	.46	.44	.40	.43	.40
	G	.51	.48	.45	.50	.47	.44	.46	.44
	F	.54	.51	.48	.52	.50	.47	.49	.47
	E	.59	.56	.53	.58	.55	.52	.54	.52
	D	.63	.60	.57	.62	.59	.57	.58	.57
	C	.65	.62	.59	.63	.61	.59	.60	.58
	B	.68	.65	.63	.66	.64	.62	.63	.62
	A	.69	.67	.65	.68	.65	.64	.64	.63
	J	.34	.31	.29	.34	.31	.29	.31	.29
M.F. = .75 M.F. = .70	I	.42	.39	.38	.41	.38	.37	.38	.36
SILVERED BOWL LAMP AND GLASSTEEL DIFFUSERS	H	.45	.43	.42	.44	.42	.41	.42	.41
	G	.48	.46	.45	.47	.46	.44	.45	.44
	F	.51	.49	.46	.49	.47	.46	.47	.46
	E	.54	.52	.50	.53	.51	.49	.51	.49
	D	.57	.55	.53	.56	.54	.53	.53	.53
	C	.59	.57	.54	.57	.55	.54	.55	.53
	B	.60	.58	.57	.58	.57	.56	.56	.55
	A	.61	.59	.58	.60	.58	.57	.57	.56
	J	.23	.19	.16	.21	.17	.15	.16	.14
M.F. = .70	I	.29	.24	.22	.28	.22	.19	.21	.18
GLASS ENCLOSING UNIT	H	.33	.28	.25	.29	.26	.23	.23	.21
	G	.37	.32	.29	.32	.28	.26	.26	.23
	F	.40	.35	.32	.35	.31	.28	.28	.26
	E	.44	.40	.36	.39	.35	.32	.32	.29
	D	.48	.43	.39	.42	.38	.35	.35	.32
	C	.51	.46	.42	.44	.40	.37	.37	.34
	B	.55	.50	.46	.48	.44	.41	.39	.37
	A	.57	.53	.49	.50	.46	.43	.41	.39
	J	.18	.14	.13	.13	.11	.09	.08	.07
M.F. = .65	I	.23	.19	.17	.17	.14	.12	.09	.07
TRANSLUCENT GLASS OR PLASTIC BOWLS	H	.26	.22	.20	.19	.16	.14	.12	.10
	G	.30	.25	.22	.21	.19	.17	.13	.12
	F	.32	.28	.25	.24	.21	.19	.14	.13
	E	.36	.32	.29	.27	.23	.21	.16	.15
	D	.40	.35	.32	.29	.26	.24	.18	.17
	C	.42	.38	.35	.30	.28	.26	.19	.18
	B	.46	.42	.40	.33	.31	.29	.21	.20
	A	.48	.44	.42	.35	.33	.31	.24	.21
	J	.15	.12	.10	.10	.08	.07	.04	.04
M.F. = .60	I	.19	.15	.14	.13	.10	.09	.06	.05
GLASS OR METAL INDIRECT UNIT	H	.22	.18	.16	.14	.12	.10	.08	.06
	G	.25	.21	.18	.17	.14	.13	.08	.08
	F	.27	.24	.21	.19	.16	.14	.09	.08
	E	.31	.27	.25	.21	.18	.16	.10	.10
	D	.34	.30	.28	.22	.20	.19	.12	.11
	C	.36	.33	.30	.24	.22	.20	.13	.12
	B	.40	.37	.34	.26	.25	.23	.14	.14
	A	.42	.39	.37	.28	.26	.25	.16	.14
	J	.17	.13	.11	.11	.09	.08	.05	.04
M.F. = .75	I	.21	.17	.15	.14	.12	.10	.07	.06
SILVERED BOWL LAMP AND SHALLOW SHIELD	H	.25	.21	.18	.16	.14	.12	.08	.07
	G	.28	.24	.21	.20	.16	.14	.09	.08
	F	.31	.27	.23	.21	.18	.16	.10	.09
	E	.35	.31	.28	.24	.20	.19	.12	.11
	D	.39	.34	.31	.26	.23	.21	.14	.13
	C	.41	.37	.34	.27	.25	.23	.14	.14
	B	.46	.42	.39	.30	.28	.26	.16	.15
	A	.48	.44	.42	.32	.30	.28	.18	.16

$$\text{Lamp Lumens Required} = \frac{\text{Foot-candles} \times \text{Area of Room}}{\text{Coefficient of Utilization} \times \text{Maintenance Factor}}$$

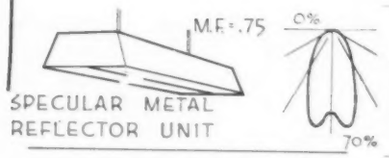
$$\text{Lamp Lumens pr. Luminaire} = \frac{\text{Total Lumens Required}}{\text{Number of Luminaires to be installed}}$$

LIGHTING OF INDUSTRIAL PLANTS
6—DATA FOR LIGHTING DESIGN

COEFFICIENTS OF UTILIZATION

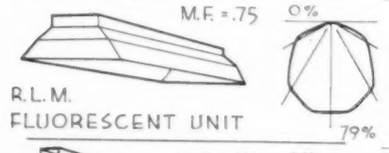
FLUORESCENT LUMINAIRES

Candlepower Distribution	Ceiling	75%			50%			30%	
	Walls	50%	30%	10%	50%	30%	10%	30%	10%
	Room Index	COEFFICIENTS OF UTILIZATION							
	J	.40	.38	.36	.39	.38	.36	.38	.36
	I	.48	.46	.46	.47	.46	.46	.45	.45
	H	.51	.51	.50	.50	.50	.49	.50	.48
	G	.55	.54	.54	.54	.52	.52	.52	.51
	F	.58	.56	.55	.55	.55	.54	.55	.53
	E	.60	.59	.58	.59	.58	.57	.57	.56
	D	.64	.61	.60	.62	.60	.60	.60	.59
	C	.65	.63	.61	.63	.62	.60	.60	.60
	B	.65	.64	.63	.64	.62	.62	.62	.61
	A	.66	.65	.64	.64	.63	.62	.62	.62



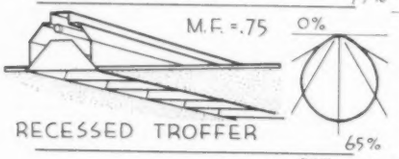
SPECULAR METAL REFLECTOR UNIT

J	.37	.32	.28	.37	.32	.28	.31	.28
I	.46	.41	.38	.45	.40	.37	.40	.37
H	.50	.46	.43	.49	.46	.43	.45	.43
G	.54	.50	.47	.53	.50	.47	.48	.47
F	.58	.54	.50	.56	.52	.50	.52	.50
E	.62	.59	.56	.61	.58	.56	.57	.56
D	.67	.64	.60	.65	.63	.60	.62	.60
C	.69	.66	.63	.67	.64	.63	.64	.62
B	.72	.69	.67	.70	.68	.66	.67	.65
A	.74	.71	.69	.72	.69	.68	.68	.67



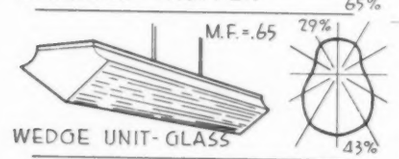
R.L.M. FLUORESCENT UNIT

J	.32	.28	.25	.32	.28	.25	.27	.25
I	.40	.36	.34	.39	.35	.33	.35	.33
H	.43	.39	.37	.42	.39	.37	.39	.37
G	.46	.43	.41	.45	.43	.41	.43	.41
F	.48	.45	.43	.47	.45	.43	.45	.43
E	.52	.50	.48	.51	.49	.47	.49	.47
D	.56	.54	.52	.55	.53	.51	.53	.51
C	.57	.55	.53	.56	.54	.52	.54	.52
B	.60	.58	.56	.59	.57	.55	.57	.55
A	.61	.59	.57	.60	.58	.57	.58	.56



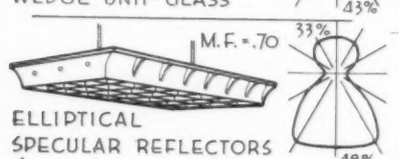
RECESSED TROFFER

J	.23	.19	.16	.21	.17	.15	.16	.14
I	.28	.24	.22	.26	.22	.20	.21	.19
H	.31	.27	.25	.29	.25	.23	.23	.21
G	.35	.31	.28	.31	.28	.26	.26	.24
F	.38	.34	.30	.34	.30	.28	.28	.26
E	.42	.38	.34	.37	.34	.31	.31	.29
D	.45	.41	.37	.40	.37	.34	.34	.32
C	.48	.43	.40	.42	.39	.36	.35	.33
B	.51	.47	.44	.45	.41	.39	.38	.36
A	.53	.49	.46	.47	.43	.41	.39	.38



WEDGE UNIT-GLASS

J	.34	.31	.29	.31	.29	.28	.29	.26
I	.41	.38	.37	.38	.36	.35	.34	.32
H	.45	.43	.41	.41	.39	.38	.37	.35
G	.49	.46	.45	.44	.42	.41	.39	.38
F	.52	.49	.47	.46	.44	.43	.41	.40
E	.55	.52	.51	.49	.48	.46	.44	.42
D	.59	.55	.53	.52	.50	.49	.46	.45
C	.60	.58	.55	.54	.52	.50	.47	.46
B	.62	.60	.58	.55	.53	.52	.48	.47
A	.64	.62	.60	.57	.55	.53	.49	.48



ELLIPTICAL SPECULAR REFLECTORS

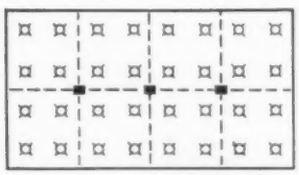
LAYOUT SUGGESTIONS

The conventional arrangements of lighting outlets to get uniform illumination with filament lamps have been adequate for an extreme range of foot-candles because of the availability of lamp sizes from 15 to 1500 watts with lumen outputs from 150 to 33,000 lumens.

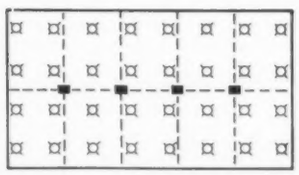
With fluorescent lamps, the wattage range at present is 15 to 100 watts, and lumen outputs from 495 to 4400 lumens. High lumen output per fixture means adding more lamps.

Whereas filament lamps offered greatest flexibility in wattage sizes, the fluorescent lamp, by virtue of its tubular form, suggests new layout and installation methods. Lacking interchangeability of wattage sizes, provision for future increases in illumination must be provided for in a flexible layout to accommodate added luminaires or rows of units to coordinate with the original installation.

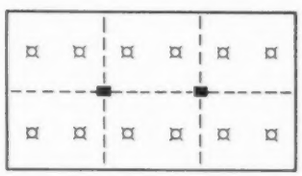
CONFORMING WITH STRUCTURAL DESIGN



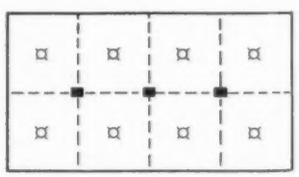
The common arrangement for the typical rectangular bay is the use of four fixtures per bay



With narrower bays, the four-two system may be used, the equivalent of three units per bay



Sometimes two units per bay are permissible, usually where the bays are extraordinarily shallow



Where bay size does not exceed maximum allowable lamp spacing, one lamp per bay may do

LIGHTING OF INDUSTRIAL PLANTS
7—DATA FOR LIGHTING DESIGN

COMPUTED ILLUMINATION VALUES
(using M.F. of 0.70)

For convenience, a Table of Values is computed from the formulas on page 77. The first part of the Table is based on 1000 lamp lumens for different areas per lamp. For example, if eight luminaires containing six 48" Mazda F white lamps in each were used in an area 20' x 48' (960 sq. ft.) the area per lamp would be 960 ÷ 48 = 20 sq. ft. per lamp; with a coefficient of utilization of .44, 1000 lumens per lamp would produce 15 foot-candles. But from the lumen output table we find this lamp (40 watts) produces 2100 lumens so the actual foot-candle result would be 2.1 x 15 or 31.5 foot-candles. This table can be used for any type of lamp; and by multiplying the area per lamp by 10 and dividing the foot-candle values by 10 the range of the table is extended from 50 to 500 sq. ft. per lamp. The second part of the table is calculated specifically for the lumen outputs of various wattages of Mazda Filament Lamps.

COMPUTED VALUES OF ILLUMINATION
USING M.F. = 0.70

FOOT-CANDLES PER 1000 LAMP LUMENS

Area in Square Feet per Lamp	COEFFICIENT OF UTILIZATION .14	.15	.17	.19	.21	.23	.25	.27	.30	.33	.36	.40	.44	.48	.53	.58	.64	.70
5	20	21	24	27	29	32	35	38	42	46	50	56	62	67	74	82	90	98
6	16	18	20	21	24	27	29	32	35	38	42	47	51	57	62	68	75	82
7	14	15	17	19	21	23	25	27	30	33	36	40	44	48	53	58	64	70
8	12	13	15	17	18	20	22	24	26	29	32	35	38	42	46	51	56	61
9	11	12	13	15	16	18	20	21	23	26	28	31	34	37	41	45	50	54
10	10	10	12	13	15	16	18	20	21	23	25	28	31	34	37	41	45	49
12	8	9	10	11	12	13	15	16	18	19	21	23	26	28	31	34	37	41
14	7	8	8	10	10	12	12	14	15	16	18	20	22	24	26	29	32	35
16	6	7	7	8	9	10	11	12	13	15	16	18	19	21	23	25	28	31
20	5	5	6	7	7	8	9	9	10	12	13	14	15	17	19	20	22	24
24	4	4	5	6	6	7	7	8	9	10	10	12	13	14	16	17	19	20
28	4	4	4	5	5	6	6	7	8	8	9	10	11	12	14	14	16	18
32	3	3	4	4	5	5	6	6	7	7	8	9	10	10	12	13	14	15
36	3	3	3	4	4	4	5	5	6	6	7	8	9	9	10	11	12	14
40	2	3	3	3	4	4	4	5	5	6	6	7	8	8	9	10	11	12
50	2	2	2	3	3	3	4	4	4	5	5	6	6	7	7	8	9	10

FOOT-CANDLES FOR SPECIFIC FILAMENT LAMP WATTAGES
(Calculated for 120-Volt Lamps)

Area per Lamp	Watts per Lamp	COEFFICIENT OF UTILIZATION .14	.15	.17	.19	.21	.23	.25	.27	.30	.33	.36	.40	.44	.48	.53	.58	.64	.70
50	100	3	3	4	4	5	5	6	6	7	7	8	9	10	11	12	13	14	16
	200	7	8	9	10	11	12	13	14	16	17	19	21	23	25	28	30	33	36
	300	11	12	14	15	17	18	20	22	24	27	29	32	35	39	43	47	52	56
	500	20	21	24	27	29	32	35	38	42	46	50	56	62	67	74	81	90	98
60	100	3	3	3	4	4	4	5	5	6	6	7	8	8	9	10	11	12	13
	200	6	6	7	8	9	10	11	12	13	14	16	17	19	21	23	25	28	30
	300	9	10	11	13	14	15	17	18	20	22	24	27	30	32	36	39	43	47
	500	16	18	20	22	25	27	29	32	35	38	42	47	51	56	62	68	75	82
70	100	2	3	3	3	3	4	4	4	5	5	6	6	7	8	8	9	10	11
	200	5	5	6	7	8	8	9	10	11	12	13	15	16	18	20	22	24	26
	300	8	9	10	11	12	13	14	16	17	19	21	23	25	28	30	33	37	40
	500	14	15	17	19	21	23	25	27	30	33	36	40	44	48	53	58	64	70
80	100	2	2	2	3	3	3	4	4	4	5	5	6	6	7	7	8	9	10
	200	4	5	6	6	7	7	8	9	10	11	12	13	14	16	17	19	21	23
	300	7	8	9	10	11	12	13	14	15	17	18	20	22	24	27	29	32	35
	500	12	13	15	17	18	20	22	24	26	29	32	35	38	42	46	51	56	61
90	100	2	2	2	2	3	3	3	3	4	4	4	5	6	6	7	7	8	9
	200	4	4	5	6	6	7	7	8	9	10	10	12	13	14	15	17	18	20
	300	6	7	8	8	9	10	11	12	13	15	16	18	20	22	24	26	29	31
	500	11	12	13	15	16	18	19	21	23	26	28	31	34	37	41	45	50	54
100	200	4	4	4	5	5	6	6	7	8	8	9	10	11	12	14	15	17	18
	300	6	6	7	8	8	9	10	11	12	13	14	16	18	19	21	23	26	28
	500	10	10	12	13	15	16	18	19	21	23	25	28	31	34	37	41	45	49
	750	14	15	17	19	21	23	25	27	30	34	36	41	45	49	54	59	65	71
110	200	3	4	4	4	5	5	6	6	7	8	8	9	10	11	12	14	15	16
	300	5	6	6	7	8	8	9	10	11	12	13	15	16	18	19	21	23	26
	500	9	10	11	12	13	15	16	17	19	21	23	26	28	30	34	37	41	44
	750	13	14	16	18	19	21	23	25	28	30	33	37	41	44	49	54	59	65
130	200	3	3	3	4	4	5	5	5	6	7	7	8	9	10	11	12	13	14
	300	4	5	5	6	6	7	8	8	9	10	11	12	14	15	16	18	20	22
	500	8	8	9	10	11	12	14	14	16	18	19	22	24	26	28	31	34	38
	750	11	12	13	15	16	18	20	21	23	26	28	31	34	38	41	45	50	55
150	200	2	3	3	3	4	4	4	5	5	6	6	7	8	8	9	10	11	12
	300	4	4	5	5	6	6	7	7	8	9	10	11	12	13	14	16	17	19
	500	6	7	8	9	10	11	12	13	14	15	17	19	20	22	25	27	30	33
	750	10	10	12	13	14	16	17	18	20	22	24	27	30	32	36	39	43	47
	1000	14	15	17	19	21	22	24	26	29	32	35	39	43	47	52	57	63	69
170	200	2	2	3	3	3	4	4	4	5	5	6	6	7	7	8	9	10	11
	300	3	4	4	4	5	5	6	6	7	8	8	10	10	11	12	14	15	17
	500	6	6	7	8	9	10	10	11	12	14	15	16	18	20	22	24	26	29
	750	8	9	10	11	13	14	15	16	18	20	22	24	26	29	32	35	38	42
	1000	12	13	15	16	18	20	22	23	26	28	31	35	38	42	46	50	55	60
190	200	2	2	2	3	3	3	4	4	4	5	6	6	6	7	8	9	10	
	300	3	3	4	4	4	5	5	6	6	7	8	8	9	10	11	12	14	15
	500	5	6	6	7	8	8	9	10	11	12	13	15	16	18	20	21	24	26
	750	8	8	9	10	11	12	13	14	16	18	19	21	24	26	28	31	34	37
	1000	11	12	13	15	16	18	19	21	23	26	28	31	34	37	41	45	50	54
210	300	3	3	3	4	4	4	5	5	6	6	7	8	8	9	10	11	12	13
	500	5	5	6	6	7	8	8	9	10	11	12	13	15	16	18	19	21	23
	750	7	7	8	9	10	11	12	13	14	16	17	19	21	23	26	28	31	34
	1000	10	10	12	13	15	16	18	19	21	23	25	28	31	34	37	41	45	49
	1500	15	16	19	21	23	25	28	30	33	36	40	44	48	53	58	64	70	77
230	300	2	3	3	3	4	4	4	5	5	6	6	7	8	8	9	10	11	12
	500	4	5	5	6	6	7	8	8	9	10	11	12	13	15	16	18	20	21
	750	6	7	8	8	9	10	11	12	13	15	16	18	19	21	23	26	28	31
	1000	9	10	11	12	13	15	16	17	19	21	23	26	28	31	34	37	41	45
	1500	14	15	17	19	21	23	25	27	30	33	36	40	44	48	53	58	64	70
250	500	4	4	5	5	6	6	7	8	8	9	10	11	12	13	15	16	18	20
	750	6	6	7	8	9	9	10	11	12	13	15	16	18	20	22	24	26	28
	1000	8	9	10	11	12	14	15	16	18	19	21	24	26	28	31	34	38	41
	1500	13	14	16	18	19	21	23	25	28	30	33	37	41	44	49	54	59	65
300	500	3	4	4	4	5	5	6	6	7	8	8	9	10	11	12	14	15	16
	750	5	5	6	6	7	8	8	9	10	11	12	14	15	16	18	20	22	24
	1000	7	7	8	9	10	11	12	13	15	16	18	20	23	24	26	28	31	34
	1500	11	12	13	15	16	18	19	21	23	25	28	31	34	37	41	45	49	54
350	750	4	4	5	6	6	7	7	8	9	10	10	12	13	14	15	17	19	20
	1000	6	6	7	8	9	10	10	11	13	14	15	17	18	20	22	24	27	29
	1500	9	10	11	13	14	15	16	18	20	22	24	26	29	32	35	38	42	46
400	750	4	4	4	5	5	6	6	7	8	8	9	10	11	12	13	15	16	18
	1000	5	6	6	7	8	8	9	10	11	12	13	15	16	18	20	21	24	26
	1500	8	9	10	11	12	13	14	16	17	19	21	23	25	28	31	34	37	40

LUMEN OUTPUT OF LAMPS

MAZDA C LAMPS

Watts	Lumens‡ 110-120 Volt	220-260 Volt
60	830c	480c ★
75	1100b	
100	1600b	1250c
150	2600b	
200	3700b	2950c
300	5900b †	
300	5750c	4850c
500	10000c	8750c
750	14500c	13500c
1000	21000c	19500c
1500	33000c	

MAZDA H LAMPS

Watts	Type	Lumens‡
100	H4	3500c
250	H2	7500d
400	H1	16000d
1000	H6	65000a

MAZDA F LAMPS

Watts	Lumens‡ Daylight	White	Soft White
15	495e	615e	435e
20	730e	900e	640e
30	1200e	1450e	1050e
40	1700e	2100e	1500e
65	1800d	2100d	
100	3350d	4200d	

RF LAMPS

Watts.....85 Lumens.....4000 Life.....3000 hours

‡ At rated voltage operation
† Medium-base lamp
★ 50-watt lamp
a 75 hours life
b 750 hours life
c 1000 hours life
d 2000 hours life
e 2500 hours life

FIGURE 1

ALLOY WATER SERVICE PIPE

A WATER-SERVICE pipe extruded from an alloy of lead, magnesium, calcium and tin is being stressed as available now for prompt delivery. This pipe is not an emergency product but was widely utilized, according to the manufacturer, prior to current shortages in other water service pipes. It retains the ability of lead to withstand corrosion and is recommended where steady working pressures do not exceed 125 lbs. per sq. in. Flared tube fittings of malleable iron have been developed for use with the pipe. These products are recommended solely for conveying water from main to meter. American Smelting and Refining Company, New York City. (See figure 1.)

ALUMINUM HEATING SECTIONS

A UNIT HEATER, made since 1929 with aluminum heating sections, is now being made with cast iron sections. The manufacturer states that the new unit is free from electrolysis, that causes corrosion, leaks and breakdowns, as only one type of metal comes in contact with steam or hot water, and that for stability and service the product will be entirely dependable in operation. 8 sizes. D. J. Murray Manufacturing Company, Wausau, Wis.

MALLEABLE IRON FITTINGS

FITTINGS of galvanized malleable iron have been developed for use with an alloy water service pipe, and are said not only to be suitable for permanent use but to improve the design of connections already made. These fittings are now being manufactured and are available for use. Grinnell Company, Providence, R. I.

OVERHEAD AIR DIFFUSER

FOR AIR CONDITIONED spaces with high ceilings there is a new thermostatically controlled overhead air diffuser. It is recommended for combined heating and cooling installations which require that the outlet be mounted 25 ft. or more from the floor. Directional air flow is automatically controlled and the diffuser can handle supply air with a wide range of temperature. Barber-Colman Company, Rockford, Ill.

PLASTICS FOR PLUMBING

A LINE of plumbing fixtures and showers, for defense housing, in line with the Defense Housing Critical List, offers plastic handles and escutcheons, with exposed metal parts unplated emery finish. Speakman Company, Wilmington, Del.

SLOTTED WOOD MOLDINGS

A NEW slotted wood molding, designed in various styles for use wherever ceiling or curtain traverses are specified, is now being offered. The molding comes with a patented slide curtain-hanging feature which eliminates the need for metal curtain rods and fixtures. This device is a woven cotton tape set at intervals with sliders. After the tape is sewed to the top of a curtain the sliders are inserted into the slot, one after the other, through a small aperture near the end of the molding. With double slot moldings glass curtains or blackout curtains can be hung under draperies. The moldings are made of kiln-dried and processed medium-hard woods and come in 4-, 6-, 8-in. and other standard lengths. Jiffy Join, Inc., 203 E. 18th St., New York City. (Fig. 2.)

FIGURE 2

PROJECTED WOOD SASH

A PROJECTED wood sash, engineered by an architectural firm under supervision of a technical committee of the National Door Manufacturers Association of Chicago, has been announced. The sash are offered in 18 standard basic units, each unit an opening in itself. The units may be installed individually, or may be combined in height and width, it is claimed, to meet almost every installation requirement in industrial and commercial buildings, schools, hospitals, etc., and in any type of wall construction. The standardized frame is designed to accommodate either bottom-povoted in-projecting vents or top-pivoted out-projecting vents Necessary hardware for one complete unit weighs about 3 lbs. Frames are factory-fitted and sash-prefitted. Parts are treated with a toxic preservative. National Door Manufacturers Association Inc., 322 S. Michigan Ave., Chicago.

FIGURE 3

CONDUCTIVE ASPHALT TILE

A NEW conductive asphalt tile is said to be the first conductive flooring specified by the government which contains no critical materials. This low-cost tile, it is claimed, provides a surface condition which results in less than .1 megohm resistance to static electricity under certain specific conditions. The tile is recommended as a resilient flooring in arsenals, shell and bomb loading plants, powder plants, temporary field hospitals and industries in which static electricity presents a hazard. Armstrong Cork Company, Lancaster, Pa. (See figure 3.)

(continued on page 82)

NO. 3 OF A SERIES on windowless buildings, by Kinetic Chemicals Inc., makers of "Freon" *safe* refrigerants

"OUR WINDOWLESS BUILDING IS SCIENTIFICALLY DESIGNED FOR BETTER WORKING CONDITIONS"

...*says* WM. F. R. MURRIE, *President, Hershey Chocolate Corp.*

"ONE of our major objects in designing our windowless building was to provide the best possible working conditions for our employees. Our experience in this building since 1936 has proved to us that we have been successful in that attempt.

"The construction of this modern building was not expensive. It cost considerably less to build than if it had been of the conventional type. Long walls, unbroken by many windows with their resultant hanging of awnings, inside shades and installation of screens, reduced the initial cost considerably. Maintenance costs are kept correspondingly low by elimination of windows to be cleaned."

Windowless buildings are receiving particular attention today because of their specific advantages in the war economy. Among those advantages are: Production need not be interrupted during blackouts; military secrets are readily concealed from outsiders; and scrupulous cleanliness is easily maintained, a requirement in the manufacture of airplane engines. In the Hershey building, and in today's controlled-conditions plants for war production, the safety and efficiency of "Freon" refrigerants make possible air conditioning at its best.

* * *

HERSHEY'S ATTRACTIVE RECEPTIONIST, Mrs. Alitha R. De Hart, has probably asked more people how they like windowless buildings than any other person in the world. During the last ten years, she has chatted with thousands of visitors to Chocolate Land, as well as the office employees themselves. As a result, she knows that people are invariably enthusiastic about windowless buildings *after they've actually been inside!*

Mrs. De Hart says, "Most visitors can't believe there are no windows—it's so pleasant inside. They always say they'd rather work here than in their own offices. Before this building was built, I never dreamed what a difference working in a windowless building could make. Now, I'm certain I'd never enjoy working in an ordinary building again!"

(continued from page 80)

PLASTIC PREVENTS GLARE

A GLARE-ELIMINATING plastic sheeting for industrial application is said to lower the surface brightness of fluorescent lamps while transmitting high-intensity, comfortable illumination. A shield of this sheeting may be attached to fluorescent reflectors. It is said to be nonfragile, lightweight, pliable and shatterproof. Ivan T. Johnson Company, Inc., 95 Madison Ave., New York City.

PLASTIC FLUSH ELBOW

PLASTIC is used to make a new flush elbow for connecting tank to water closet. According to the manufacturer, the elbow does not crack or dent in packing or handling with tools, is leakproof, impervious to all water content, noncorrosive and invincible to electrolysis. 4 in. by 6 in., 2 in. outside diameter. American Molded Products Company, 1753 N. Honore St., Chicago, Ill.

LOW-COST SIDING

A LOW-COST siding material, with weather-resistant mineral granule finish that eliminates painting, has been put on the market. It can be used over any kind of sheathing, and for temporary construction may be applied directly to framing provided the studs are on 16-in. centers. The product consists of two sheets of heavy roofing felt saturated with an asphaltic compound and bound together with a high melting point asphalt adhesive. The outer surface of the sheets receives an extra coating of asphalt, into which are embedded mineral granules. The material is recommended for army barracks and other military buildings, factory structures, low-cost housing. 3/16 in. thick; 3 and 4 ft. wide; 6, 7, 8, 9, 10 ft. long. Celotex Corporation, 919 N. Michigan Ave., Chicago, Ill.

WOOD COMPARTMENTS

A MANUFACTURER of toilet compartments has converted its four types of steel compartments to all-wood construction as a temporary substitute, using plywood for partition panels and doors. They are said to compare favorably in appearance with longer lasting steel toilet compartments. Sanymetal Products Company, Inc., Cleveland, Ohio. (See figure 4.)

(continued on page 84)

FIGURE 4

PHOTOMURAL VISTAS

now dramatized in glass

The Cottonwood Room, Blackstone Hotel, Omaha. Photomural by Kaufmann and Fabry. Design by Johns H. Hopkins.

Here's another new and interesting use of polished plate glass in modern interior design. Dramatized with lights of plate glass, this arresting vista in The Cottonwood Room of Omaha's Blackstone Hotel is what is believed to be the first full wall size, full color, illuminated transparency to be installed. It extends over the entire curved wall, seven and one-half feet by fifty-four feet, and is lighted from behind. In addition to its novel decorative effect it provides the illumination for the entire room.

The use of clear Libbey·Owens·Ford glass on both sides of the photomural contributes to the vista effect, provides clear vision, and protects the mural.

Here's a novel technique that offers a fine medium of dramatizing locale . . . scenes, historical points of interest, etc. . . . in reception rooms, foyers, dining rooms, lobbies, corridors and other places in public buildings, such as post offices, libraries, municipal and federal buildings, and in hotels and restaurants.

Here also is an ideal application for Libbey·Owens·Ford Polished Plate Glass. Its smooth, clear surfaces and greater freedom from imperfections and distortion fit it perfectly for installations where clear vision is an essential. Libbey:Owens:Ford Glass Company, 1329-A Nicholas Building, Toledo, Ohio.

L O F

LIBBEY·OWENS·FORD

QUALITY *Flat Glass* PRODUCTS

(continued from page 82)

PACKAGED FURNACES

THREE gas-fired models and one oil-fired model constitute a line of winter air conditioners which have been placed in production. Factory-wired and assembled, the units are said to minimize time, labor and expense of installation. They have been approved for close-quarter installations. Gas-fired model has output ratings of 48,000, 72,000 and 96,000 Btu per hr. Oil-fired, 100,000 Btu per hr. General Electric Co., Bloomfield, N. J.

SHOWER CABINET—NON-CRITICAL

A LOW-PRICED shower cabinet, using non-critical materials, has walls of hard-pressed, treated fiberboard; receptors of reinforced non-slip precast cement composition, galvanized steel frame. One standard size with cast iron drain and soap dish; also shower head, valves, curtain and curtain rod as optional equipment. The product should meet the need in war housing, camps, naval bases, plants, schools, hospitals. Installation speed is another feature. Milwaukee Stamping Company, South 72nd St., Milwaukee.

TO SHATTERPROOF WINDOWS

TO "SHATTERPROOF" windows and lighting fixtures and prevent broken glass from flying in factories, office buildings, public buildings, etc., a liquid can be brushed or sprayed on to form a film said to have tensile strength of 3,000-5,000 lbs. per sq. in. Elongation over 20 per cent permits considerable movement of glass without rupture of film. The coating, which, it is stated, is lightproof, will not pinhole and has been flameproofed. CLOPAY, 1207 Clopay Square, Cincinnati, Ohio.

WAR PLANT VENTILATORS

DESIGNED to prevent transmission and reflection of illumination from the building interior or reflection of light from the night sky is a new series of war plant ventilators for blackout and other factory buildings. They are available in three types. 1. Exhaust ventilators to remove air from the plant. 2. Supply ventilators to draw in and circulate outdoor air. 3. Tempering ventilators to deliver and circulate warmed air. Three capacities—10,000, 15,000, 20,000 Cfm. Single or in multiple. Carrier Corporation, Syracuse, N. Y.

SUBSTITUTE FOR RUBBER RUNNER

AN ASPHALT composition material, now available for delivery, has been found highly satisfactory, according to the manufacturer, as substitute for rubber runners and mats on floors subject to heavy traffic. Corrugations or ribs form a non-skid surface. In rolls 36 in. wide, 30 ft. long. Philip Carey Manufacturing Company, Lockland, Cincinnati, Ohio.

DEPENDABILITY

Proof that a Carrier Centrifugal Refrigeration Machine will give you dependable operation at Low Cost year after year

365 Days Around the Clock is the operating schedule of the Carrier Centrifugal Refrigeration Machine installed in the blast furnace of the Woodward Iron Company, Birmingham, Ala.

20 Years Service is the record of the first Carrier Centrifugal installed at the Onondaga Pottery Company, Syracuse, N. Y.—still operating as efficiently as ever.

7200 Hours A Year. The Carrier Centrifugal at the Narragansett (R. I.) Brewery operates on an average of 7200 hours a year—and brings the owner large annual savings.

24 Hours A Day. Operating 24 hours a day every day, the Carrier Centrifugal Refrigeration Machine at the Skenandoa Rayon Corp., Utica, N. Y. has drastically cut processing and refrigeration costs.

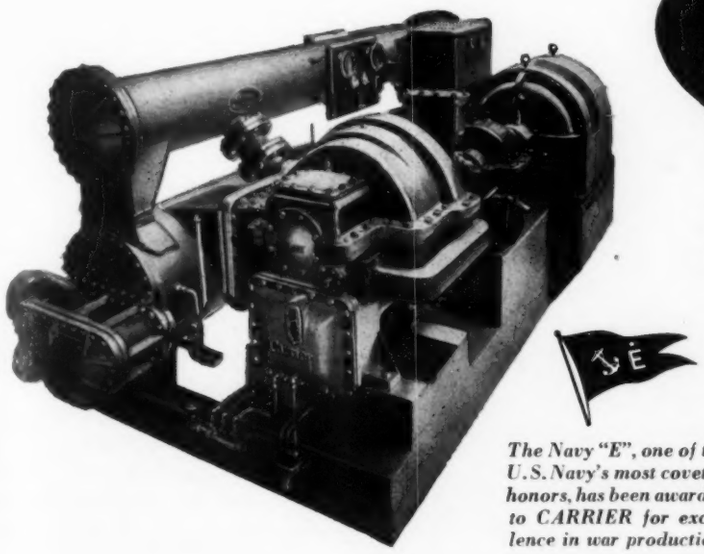
More Than 1000 In Use. Dr. Willis H. Carrier invented the Centrifugal Refrigeration Machine which represents the greatest improvement ever developed in mechanical cooling. Whether the requirement is for a minus 100° F. or for 1200 tons of water chilling capacity, the new range of Carrier Centrifugals takes care of every need — will meet refrigeration requirements more efficiently, dependably and at low operating costs. The operating records of the Carrier Centrifugal Refrigeration Machines cover two decades. Carrier brings to architects and consulting engineers experience gained in both peacetime and wartime industries.

Just a Few Operating Records

WHERE INSTALLED	YEAR INSTALLED	AVERAGE HOURS PER YEAR
Convention Hall	1929	3,000
Printing Plant	1929	6,000
Textile Mill	1929	4,254
Rayon Manufacturer	1930	7,200
Drug Manufacturer	1938	3,946
Cosmetic Manufacturer	1936	6,612
Brewery	1935	7,200
Chemical Manufacturer	1933	5,000
Hospital	1934	7,200
Fruit Storage	1933	2,400
Hotel	1934	7,200
Broadcasting Studio	1930	3,100

RECORDS LIKE THESE COME ONLY FROM DEPENDABLE OPERATION!

Carrier
Centrifugal
REFRIGERATION



The Navy "E", one of the U.S. Navy's most coveted honors, has been awarded to CARRIER for excellence in war production.

Mail the coupon below for our New 42-page Booklet. It Has the Most Complete Data on Centrifugal Refrigeration Ever Published.

CARRIER CORPORATION,
Syracuse, N. Y. Desk 128

Without obligation, send new free booklet "20 Years of Centrifugal Refrigeration."

Name_____

Company_____

Address_____

REQUIRED READING

(continued from page 20)

plan, the substantial low-cost housing, economical to maintain and comparing well in appearance with the neighboring mill supervisor's great house and with those of the town bourgeoisie.

Readers will wish that the arrangement of an otherwise readable work had been simpler: that, e.g., the chapter on the "Background of Lowell" and the appendix on the "Economic Background" had been merged, similarly "A Decade of Growth" and "The Growth of the City."

WARTIME BUILDING CONSTRUCTION. New York, Chemical Pub. Co., 1942. 151 pp., 5½ by 8½ in., illus. $4.00

A COLLECTION of 12 useful papers recording British wartime experience in the handling of materials—concrete, steel, brick, etc.; in special building types—the small hut, the single story factory; in construction types—the centerless arch, fire protection of structural steelwork.

An index is needed. A preface might have explained the references to "previous Building Editions," to "Wartime Building Editions," and to "Wartime Bulletin Chapter 3," which form the content of most of the astonishing faint patches in these unusually black pages. Statement of the fact that this "First American Edition" is a slightly abridged offset reproduction, on pages half the size of the original, of "Wartime Building Bulletins" 2-3, 5-7, 9, 11-16 of Great Britain's Department of Scientific and Industrial Research would not only have given authority to this anonymous collection of papers but would also prevent duplicate buying by libraries, firms and individual architects having purchased the Bulletins when they were published in 1940 and 1941.

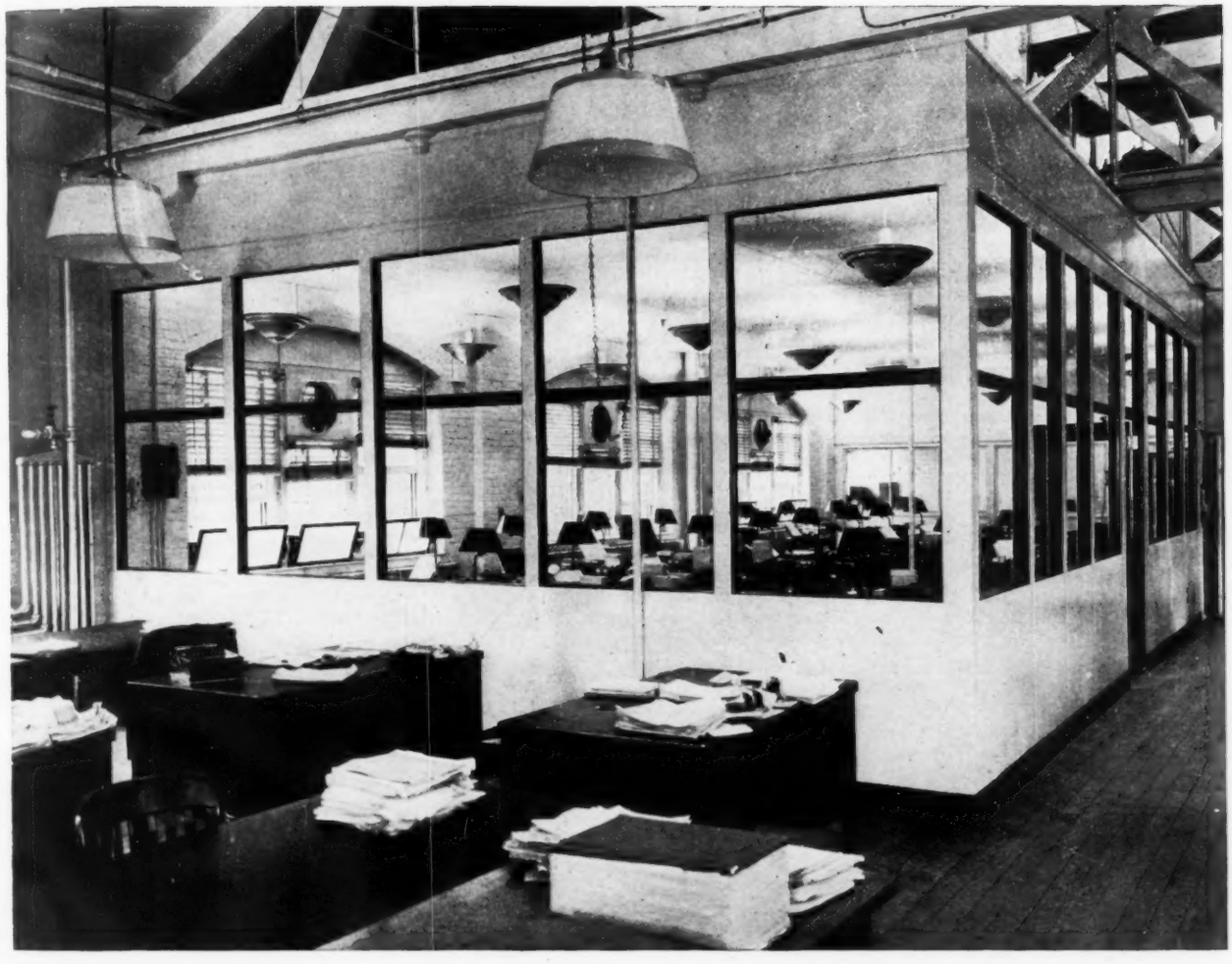
NEWPORT TOWER. By Philip Ainsworth Means. New York, Holt, 1942. 344 pp., 6 by 9¼ in., illus., $5.00

IN architecture lies the best hope of solution of the 100-year controversy about the origin and purpose of "the most enigmatic and puzzling building in the U. S." After examination of over three hundred documents, from 1823 to 1939, witnesses in the case of what Vilhjalmur Stefansson calls the "non-fictional detective story," a former associate in anthropology at Harvard's Peabody Museum, identified also with Yale-National Geographic, Smithsonian, Haye Foundation and other researches, urges that space around the tower be excavated. He devotes half of his well considered guess as to results to their being nothing found, about a third to Norse evidence of 1211-1400, a twentieth to 1492-1580 European evidence, about a tenth to 17th century American.

HOW TO LIVE IN THE TROPICS. By Virginia Lloyd Hunt. New York, Harcourt Brace, 1942. 178 pp., 5½ by 8¼ in., tables, $2.00

WRITTEN for the traveller and packed with observations on equipment and techniques for successful living in the tropics, this handbook includes many observations useful to those

(continued on page 88)



Write SPEED into your Plant Office Specifications

WITH THESE MODERN MOVABLE WALLS

FEW, if any partitioning materials can be installed as rapidly as Transite Walls. In many cases these modern, movable partitions permit *complete new offices to be erected overnight*. And their asbestos-cement composition assures unusual durability, maximum fire-safety, continued low maintenance. Check these advantages—

QUICKLY INSTALLED—because of a patented construction method. Routine work need not be interrupted. Relocation is accomplished with 100% salvage.

STRONG, DURABLE, FIRE-RESISTANT—Transite Walls provide all the solidity and privacy of fixed masonry walls. They are highly resistant to shock, impact and abuse.

FORM ANY TYPE PARTITION—free-standing, ceiling-high, solid, or in combination with glass. Ideal for any type of plant or office partition.

ATTRACTIVE APPEARANCE—The natural gray color of Transite Walls is ideal for plant or general office use. While this finish is permanent in itself, walls may be painted or treated with practically any other decorative finish.

RELEASE CRITICAL MATERIALS FOR WAR USE—because Transite Walls are composed principally of asbestos-cement sheets.

For details on J-M Transite Walls, see our Catalog in Sweet's, or write for brochure TR-22A. Johns-Manville, 22 E. 40th St., New York, N. Y.

JM

Johns-Manville TRANSITE *Movable Asbestos* **WALLS**

REQUIRED READING

(continued from page 86)

knowing only temperate zones who may be called upon to design housing in our new bases in tropical and subtropical countries. The effect of a hot climate on the newcomer, tropical aspects of everyday functions and habits—perspiration, work, eating, drinking, dress, etc.—as well as sanitation and hygiene are handled in a thoroughly practical way, supported by citations from leading authorities.

CITY-WIDE STUDIES. WPA of the City of New York under sponsorship of the Mayor's Committee on City Planning New York, Regional Plann. Assoc., 400 Madison Ave., [1942]. 3 vol., 137, 122, 176 pp., 128 maps, illus., tables. $1.50 a set

AVAILABLE on Sept. 10 at a nominal price will be a limited edition of three volumes condensed from studies made by WPA workers under expert direction in 1934-38.

These basic factual studies were made possible by the availability over a four-year period of an average of 250 workers to carry out detailed investigation. Not a little of the information acquired by this low-cost million dollar project has been available to specialists of many kinds during and since the years of its making; the distribution of this limited edition on a non-profit basis will be a boon to students of city planning, especially if libraries avail themselves of this offer.

TECHNIQUE OF PLYWOOD. By Charles B. Norris. Seattle, I. F. Laucks, Inc., 1942. 249 pp., 4½ by 7½ in., diags., tables. $2.50

TOGETHER the works "Wood Technology" by Harry D. Tieman and "Modern Plywood" by Thomas D. Perry published last spring (ARCH. RECORD, Mar., 42, p. 26) and the present handbook cover plywood for manufacturer, engineer, architect, wood worker and the general reader. The present work, reprinted from a well tested series in the *Hardwood Record*, contains in convenient and relatively inexpensive form what the technician needs to know. Any reader will enjoy the chapter by Mr. Laucks on principles and practices of gluing.

FIELD INSPECTORS' CHECK LIST FOR BUILDING CONSTRUCTION. Washington, D. C., Govt. Printing Office, 1942. 68 pp., 5 by 7½ in., $0.20. (BMS81).

A USEFUL handbook compiled by the CHC's Subcommittee on Structure for use of the clerk-of-works. The arrangement is by order of procedure, and the enumeration of items under each stage of the work is detailed. A chapter on Final Records—guaranties, reports, contractors' affidavits, utility approvals, etc.—is well calculated to avoid many a painful afterthought; and there are useful appendices on points to watch.

STANDARD FILING SYSTEM. Washington, D. C., Amer. Inst. of Architects, 1942. 63 pp. 8½ by 11 in. $1.00 (AIA Doc. 172).

TO MEET changes in one of the least stable of all industries, the field of building materials, appliances and equipment, comes this thorough revision of the 1937 edition with a greatly expanded index.

POSTWAR POTENTIALS FOR BUILDING

(continued from page 50)

If no emergency arises, that will mean that industry, individuals and local communities will be able to carry on with a minimum of Federal aid. If there is an unemployment emergency, the Federal government will step in. In either case the volume of public works projects will be very large.

Even if the Public Works Reserve program should never be implemented by Federal financial aid, it will have taught many local government bodies to program their improvement needs far ahead on a long-range basis; the six-year capital budget is usually the central feature of such a program. Such long-range programs are, of course, subject to revision, curtailment or expansion as they progress toward execution.

Since increased community facilities are an essential supplement to increased private construction, since community improvement needs are paramount in developing civilized living, and since very substantial progress is being made in advance planning of improvement programs, public works will contribute a vast amount of activity during the postwar period of catching up with deferred construction and well beyond the period. Industrial and transportation developments, improved community planning and urban redevelopment will all augment public improvement needs.

4. Prospects of Economic Expansion: Assuming victory, the potentialities of great economic expansion and prosperity for the United States, with its great resources, technological development, enlarged productive facilities, high level of income and outstanding position in world affairs, are enormous. With sound policies and good management, with reference to our domestic affairs and to international relationships, this country should enjoy hereafter a greater prosperity than it or any other country has ever had.

Such prosperity cannot be achieved without enormous construction activity. Careful appraisal of long-range prospects indicates that the decade following the war should have a larger volume of construction than any previous decade in our history—assuming victory.

Big facts

New War Department Building believed to be the largest office building in world . . . Will house 30,000 workers . . . Air Conditioning System required approximately 25 miles of Careyduct . . . 10,000 Careyduct Elbows and fittings . . . 80,000 pounds of Carey Adhesive Cement . . . A total of 65 carloads of material . . . Careyduct saved over 1,500,000 pounds of steel in the air conditioning system of this building.

Photographs in this advertisement released by Materiel Div., U. S. Army Procurement Div.

NEW WAR DEPARTMENT BUILDING

"An Air-Conditioned City in Itself"

SAVES 1,500,000 POUNDS OF STEEL

by using

Careyduct

THE ALL-ASBESTOS INSULATED DUCT

Meets Rigid Standards of Government Engineers —Advantages Over Metal Demonstrated in Important Jobs All Over Nation.

Millions of pounds of steel have been saved by using Careyduct in air-conditioning the new War Department Building at Arlington, Va., and hundreds of other important public and private structures throughout the country. Yet saving vital steel is but one of the many advantages of using Careyduct. Made entirely of asbestos, it is a natural sound absorber; hushes equipment noises and metallic "cracking" due to pressure changes or expansion strain. By reducing noise, higher velocities with smaller sizes may be used, solving difficult problems where space is limited.

Factory fabrication eliminates costly shop work; saves time, man-power. Silent erection permits installation in occupied buildings such as hospitals, radio stations, banks, etc. With all its advantages, Careyduct costs no more, frequently less, than insulated metal duct.

To conserve steel—insure better air-conditioning—specify CAREYDUCT. Write for full information, address Dept. 21.

THE PHILIP CAREY MFG. COMPANY

Dependable Products Since 1873

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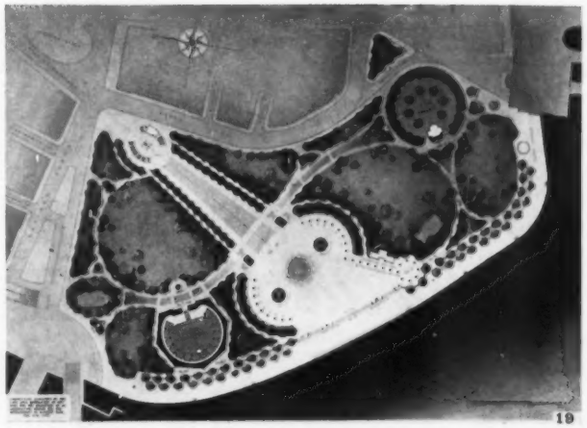
In Canada: The Philip Carey Co., Ltd. Office and Factory: Lennoxville, P. Q.

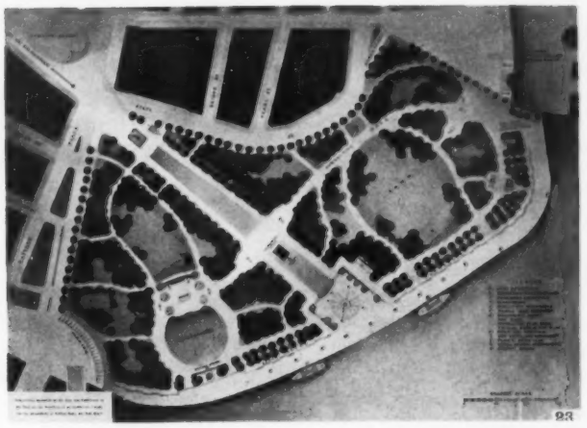
Architect: George Edwin Bergstrom
General Contractors: John McShain, Inc.
Heating and Air Conditioning: Baker Smith & Co., Inc. Mehring & Hanson Co.
Consulting Engineer: Chas. S. Leopold

THE RECORD REPORTS

(continued from page 16)

Winning Designs for New York's Battery Park





First prize winning design (above) was that of Walter W. W. Jones, Brooklyn architect. Below is design by Philip Sanfilippo and Vito P. Battista, Brooklyn architects, and David Davis, Manhattan landscape architect, which took the second award

A VOLUNTARY EFFORT on the part of a group of citizens and by the Fine Arts Federation of New York, the competition for redesigning Battery Park was conducted as "a contribution to the furtherance of civic development and the preservation of historic structures." The program specifically stated that the competition was conducted solely as a public-spirited gesture, that it had no authorization from City authorities, nor did it contain any implication that the design or services of the winner would be utilized. In effect, the competition served as a counter-argument to the contention of Park Commissioner Robert Moses that in reconstructing the park, the old Aquarium, a favorite "sight" of the city, should be demolished; in all competition drawings, the Aquarium is not only maintained but restored to its original form as Fort Clinton—a basic requirement of the competition.

The first prize of $500 (the competition was restricted to registered architects and landscape architects of Greater New York) went to Walter W. W. Jones, Brooklyn architect; second prize was awarded to a collaborative group: Philip Sanfilippo and Vito P. Battista, both Brooklyn architects, and David Davis, Manhattan landscape architect. Honorable mentions were given to the designs submitted by Delano and Aldrich, Manhattan architects; Harry Leslie Walker, architect, also of Manhattan; and Maud Sargent, Manhattan landscape architect.

Thirty-seven plans were entered, and the following judges constituted the jury: James C. Mackenzie, FAIA; Edward Shepard Hewitt, FAIA; Adolph A. Weinman, sculptor, former president of the National Sculpture Society; Ralph Griswold and Armand Tibbets, landscape architects; and Thomas S. Holden, president of F. W. Dodge Corporation.